Salmon 101- a brief overview

Farm Fish Flood Stakeholder Committee
Dec 10, 2013

Lots of different fish in the Snoqualmie

- Salmonids
  - Chinook (listed)
  - Coho
  - Chum
  - Pink
  - Steelhead (listed)
  - Cutthroat
  - Bull Trout (listed)
  - Mountain Whitefish
- Others
  - 3-spine Stickleback
  - Chub
  - Brook/River Lamprey
  - Pikeminnow
  - Various Sculpins
  - Dace (minnows)
  - Pumpkinseed & Bass
  - Various amphibians
  - Various invertebrates

Northwest
Salamander

Pumpkinseed

Lamprey

Sculpin

Photo by Hans Berge
Pink

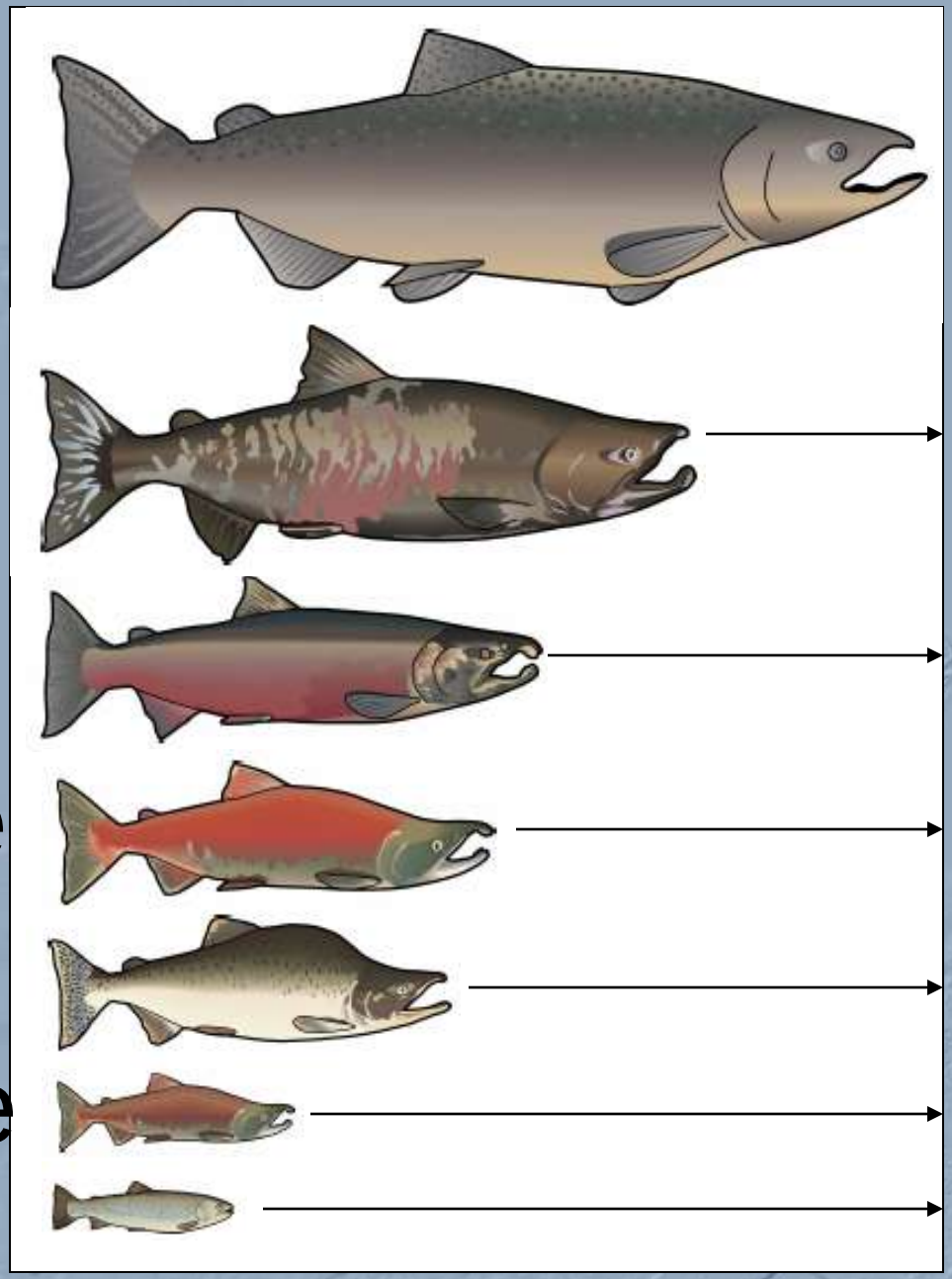
Coho
Photo by Vali Eberhardt

Steelhead
Photos by Phil Simpson

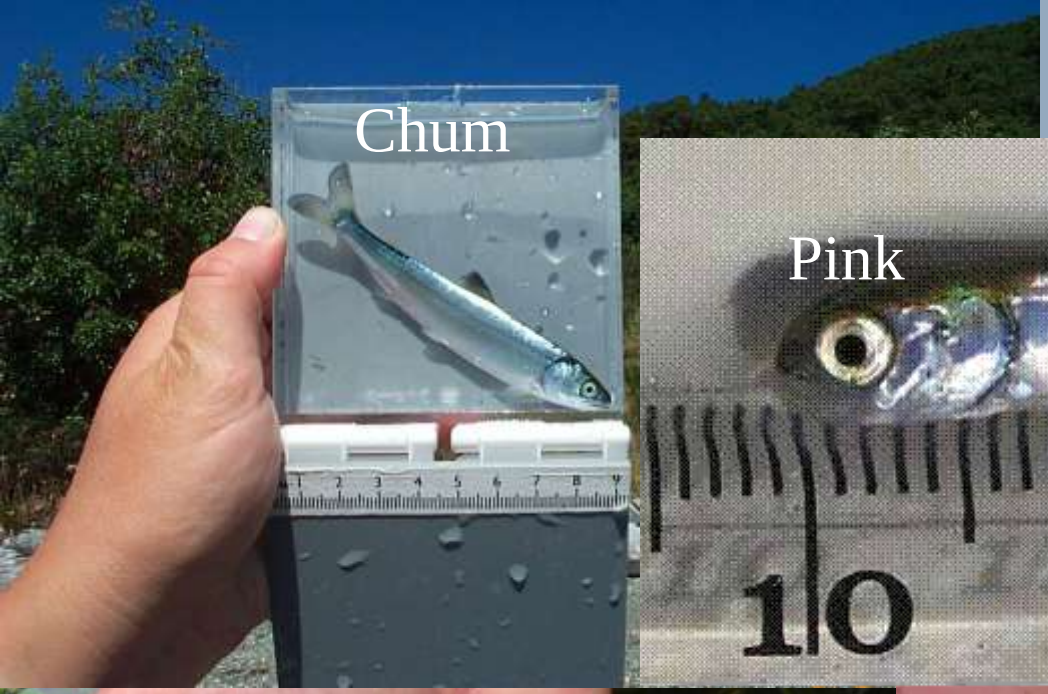
Chinook
Photo by Geoff Clayton

Chum

Sockeye
Photo by Hans Berge



	Size
Chinook	24-60”
Chum	30-42”
Coho	17-38”
Sockeye	20-28”
Pink	24-60”
Kokanee	10-18”
Cutthroat	up to 30”


Chum

Pink
10
11
12
cm
13

Chinook

Coho

Steelhead Trout

cutthroat

Bull Trout

- The first and foremost rule when dealing with salmonids—there are no solid, unbendable rules about them

- **There are general tendencies**

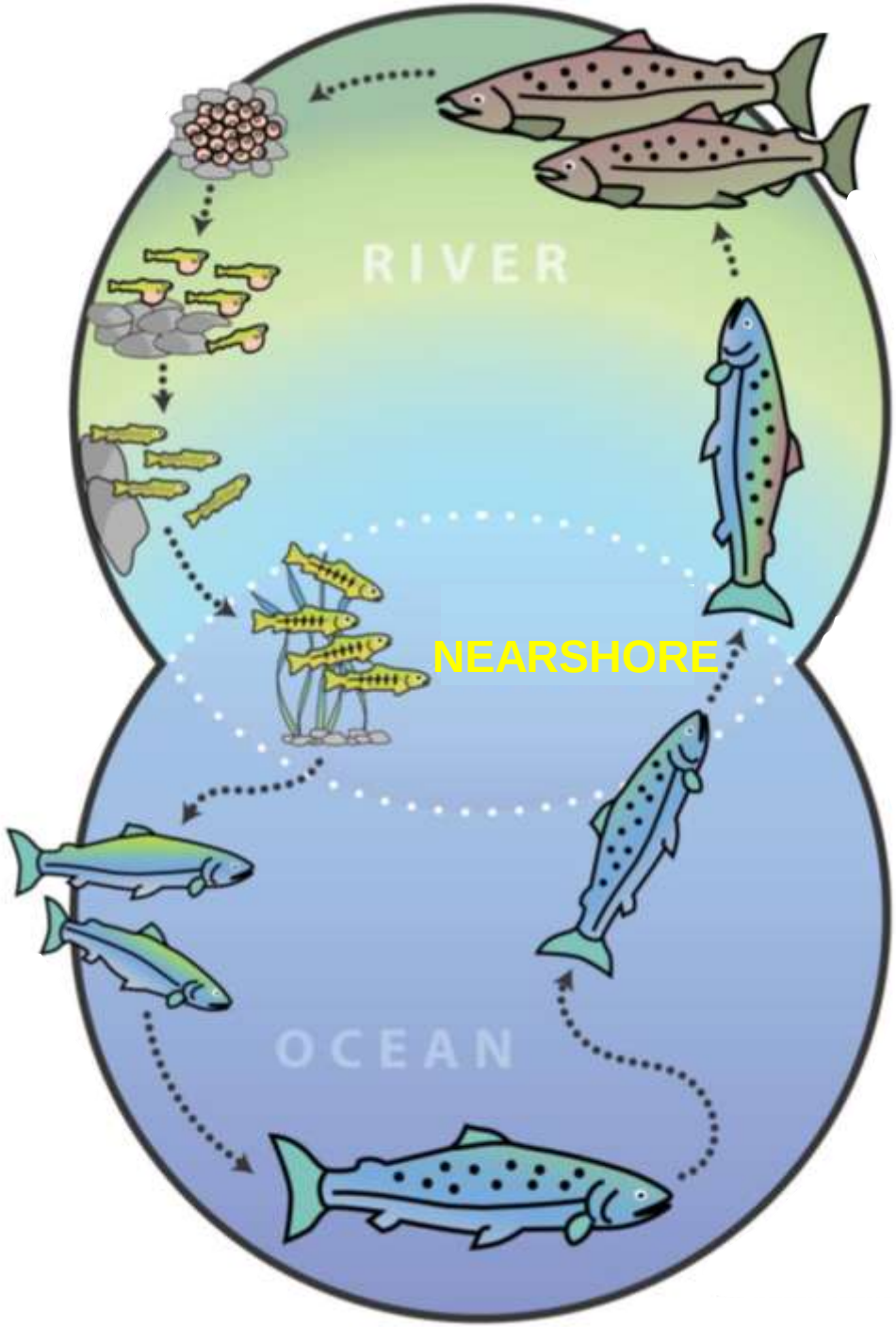
General Salmon Tendencies

- Spawning limited—spawning habitat tends to limit population size
  - Chum salmon
  - Pink salmon
  - Sockeye salmon

- Rearing limited—rearing habitat tends to limit population size
  - Chinook salmon
  - Coho salmon
  - Steelhead trout

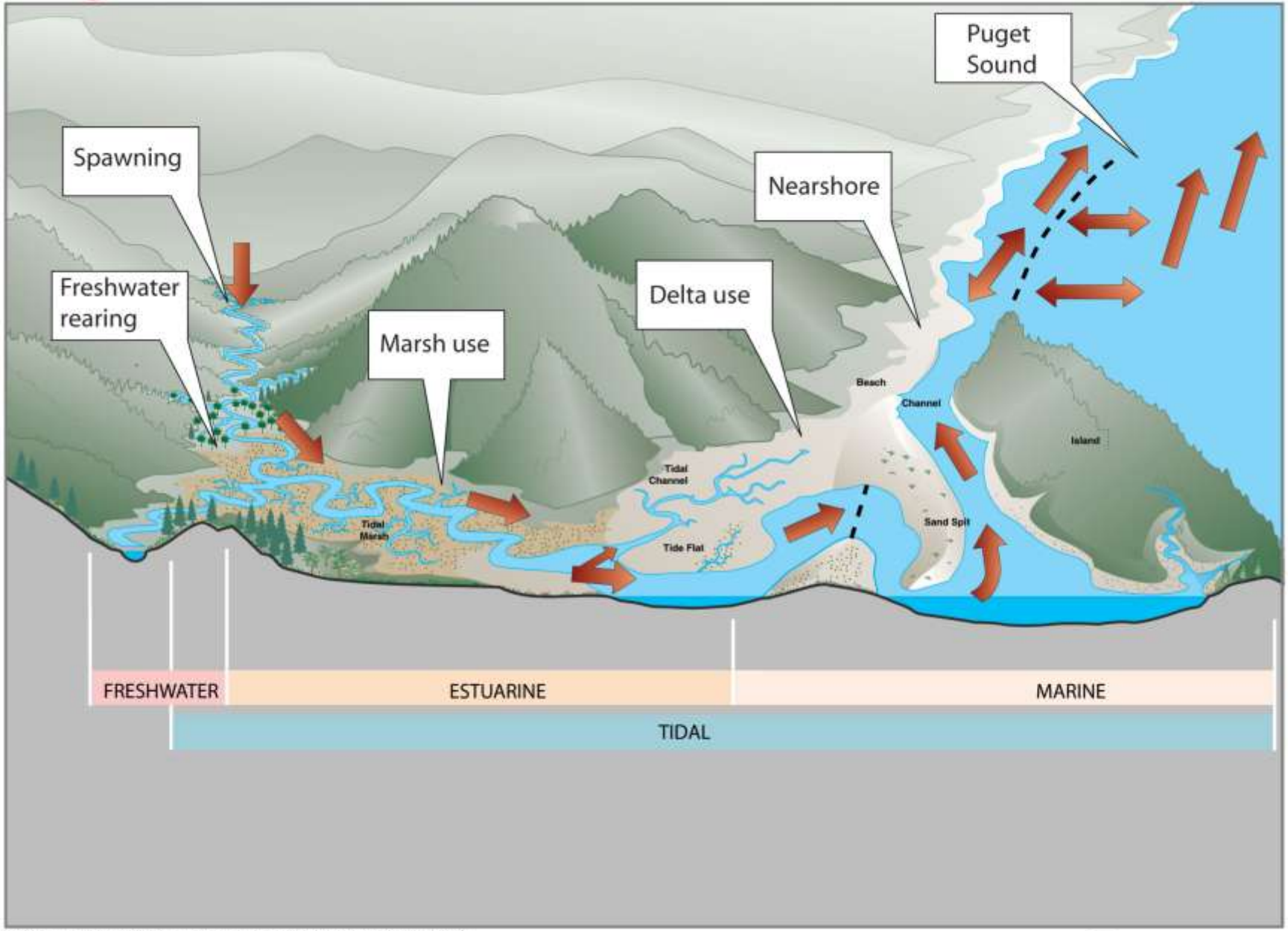
Water Quality Needs

- Generally, cooler is better
  - WA DOE Temp standards range from 12° to 17.5° C (54° to 64° F)
- Dissolved Oxygen, more is better
  - 9.5 mg/L or higher is ideal, but salmon can survive in lower levels
- Turbidity—less is better
- Nutrients—less is better
- Fecals-mostly a human health issue, but related to nutrients



- Chinook
- Coho
- Steelhead/Rainbow
- Pink
- Chum
- Sockeye
- Cutthroat

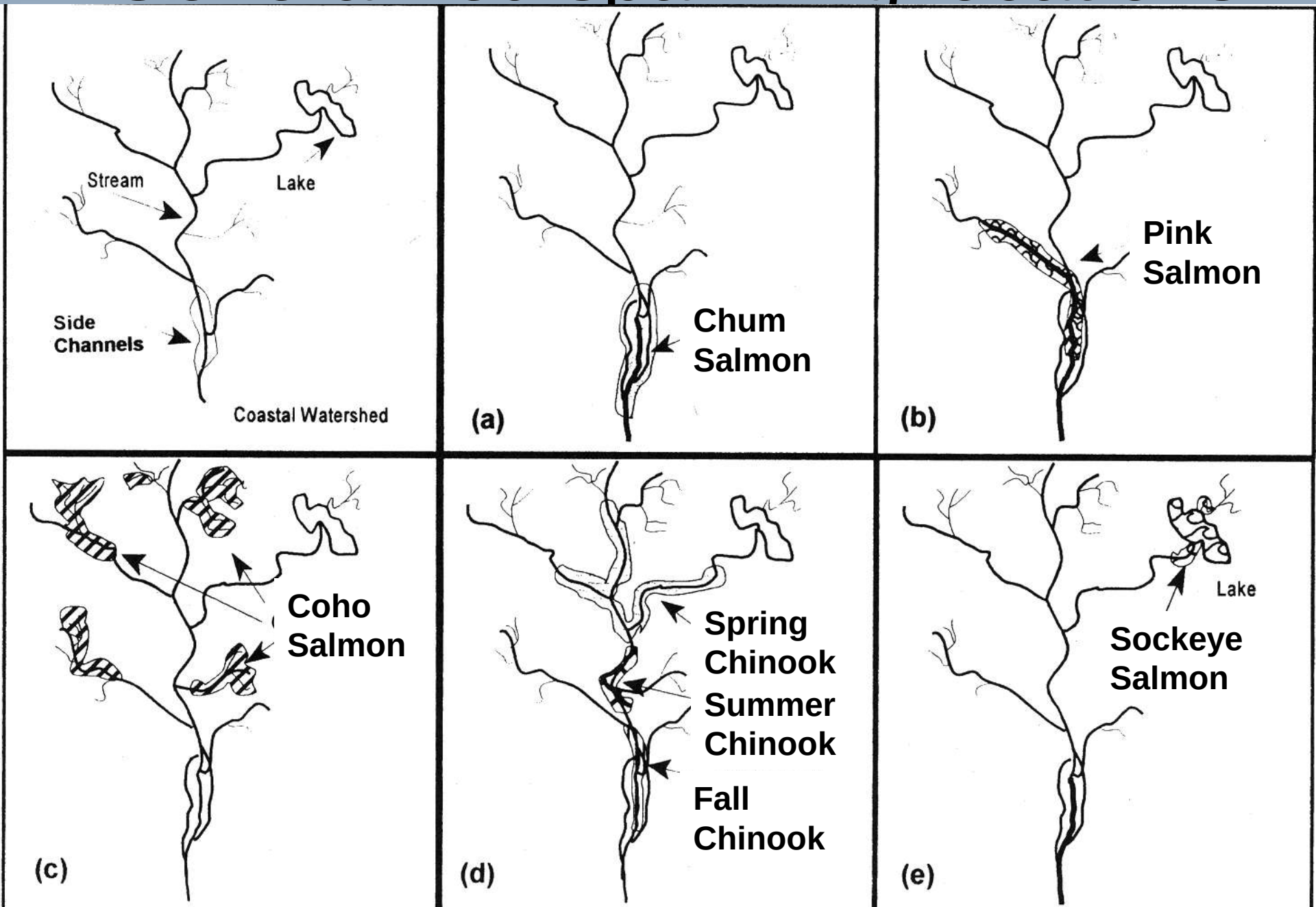
Large River Mouth showing salmon life stages



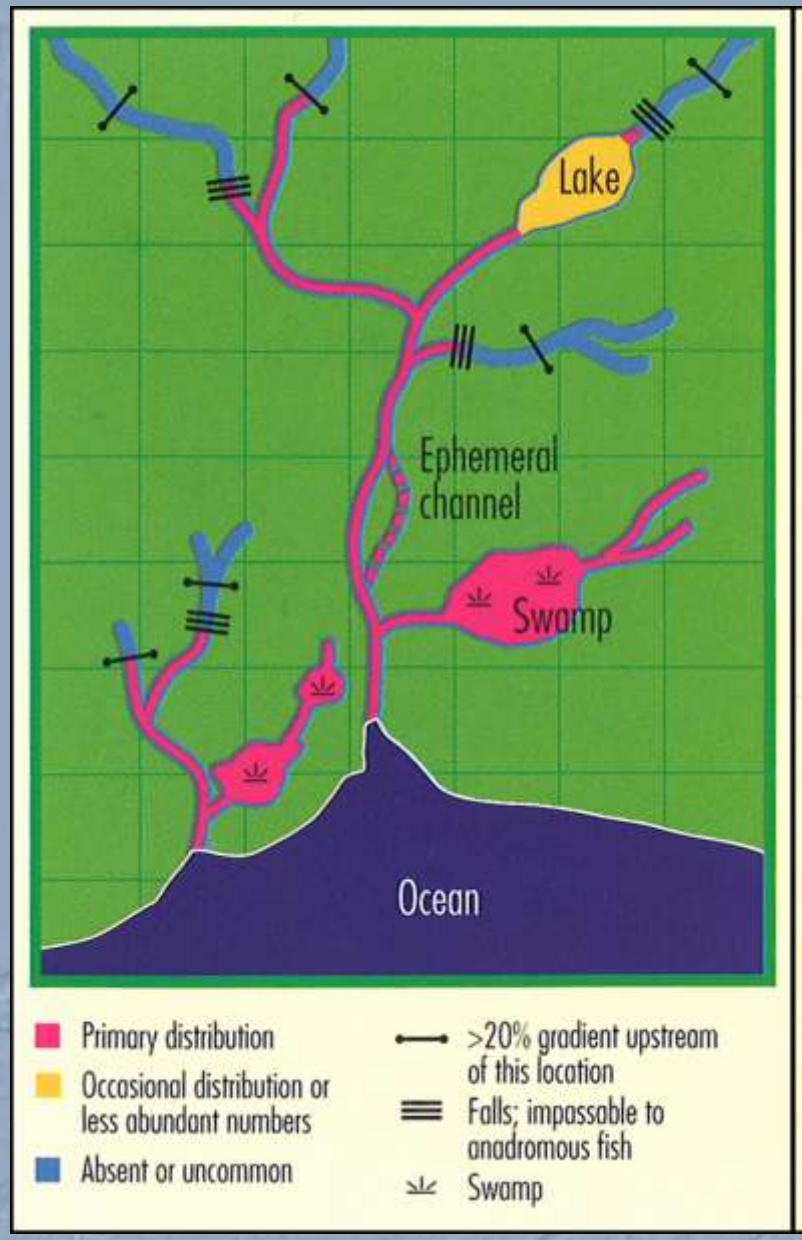
Produced by: Visual Communications and Web Unit, King County Department of Natural Resources and Parks
File Name: 9901LgRiverMouthSalmon-Kurt.ai

King County

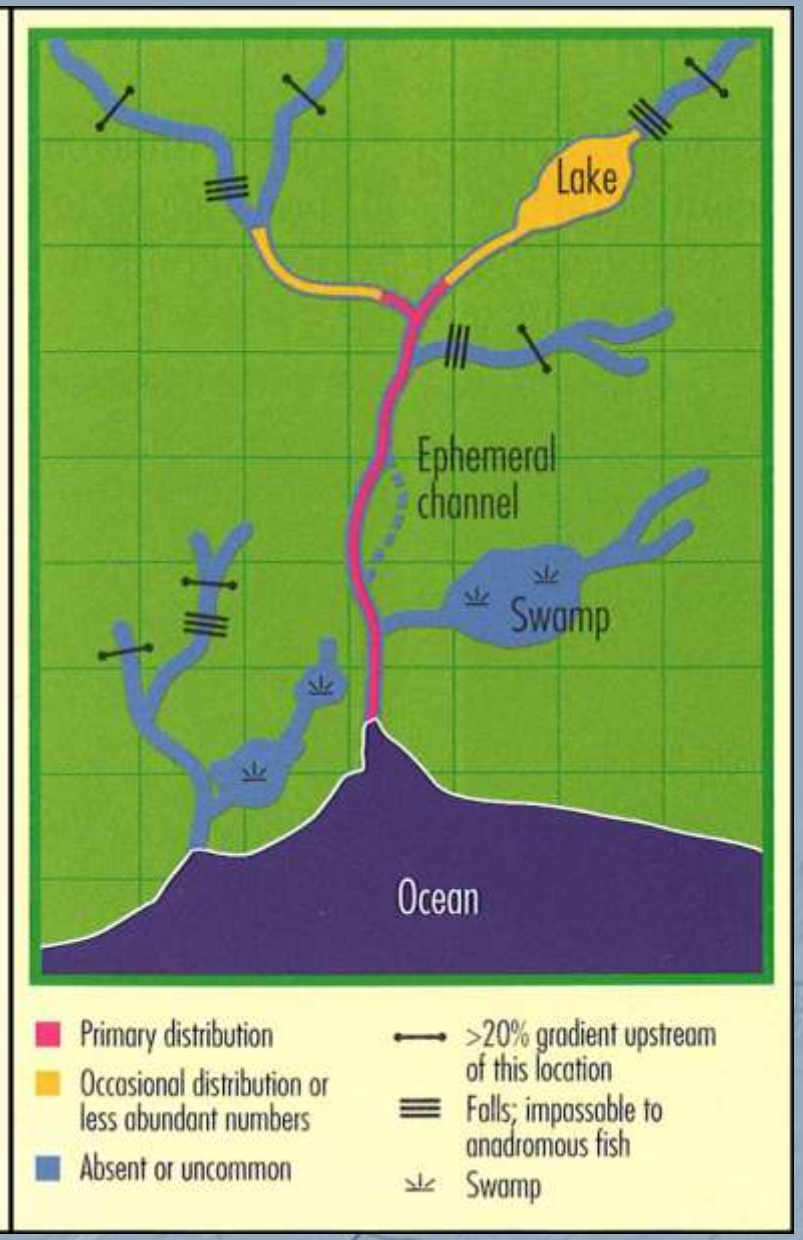
Generalized spawning locations



Coho

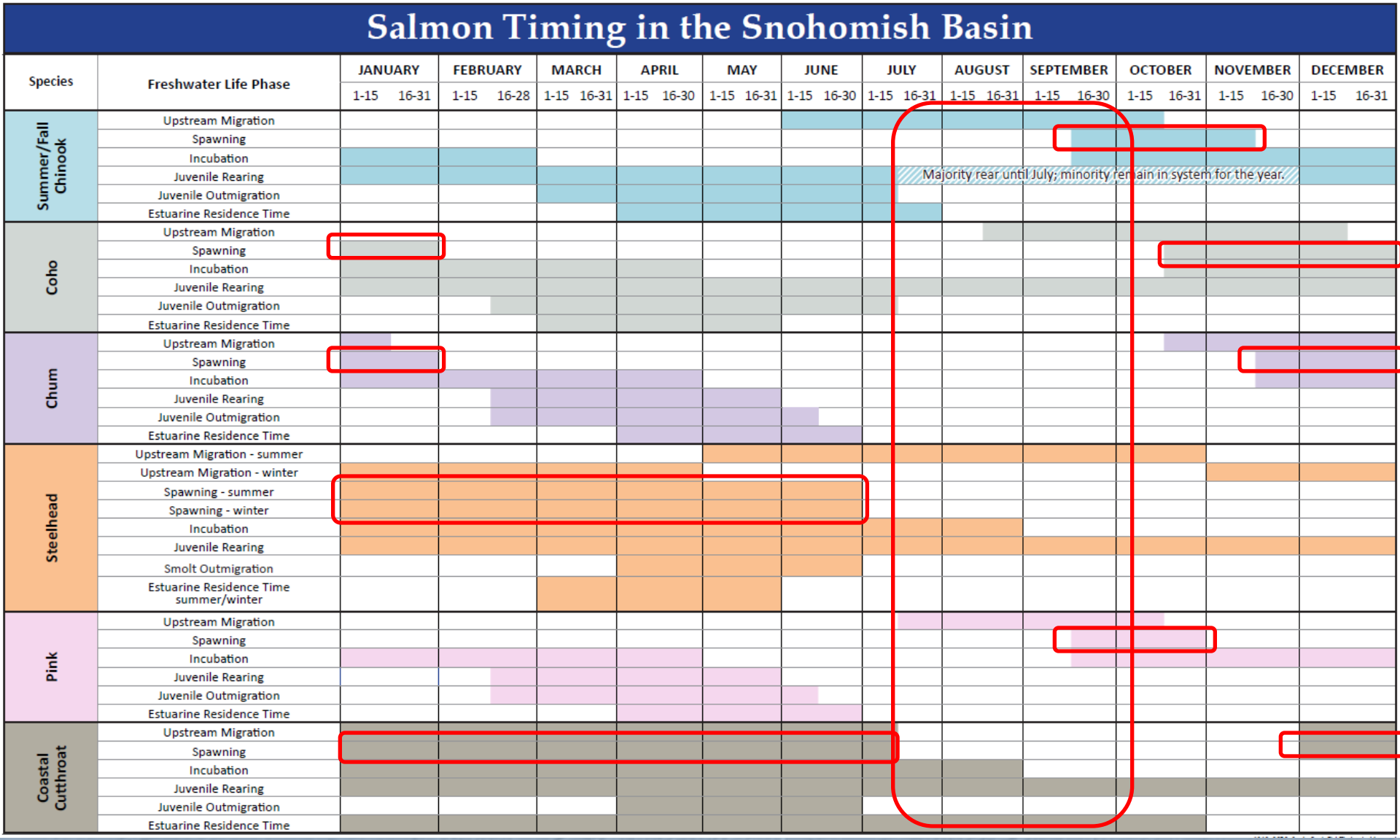


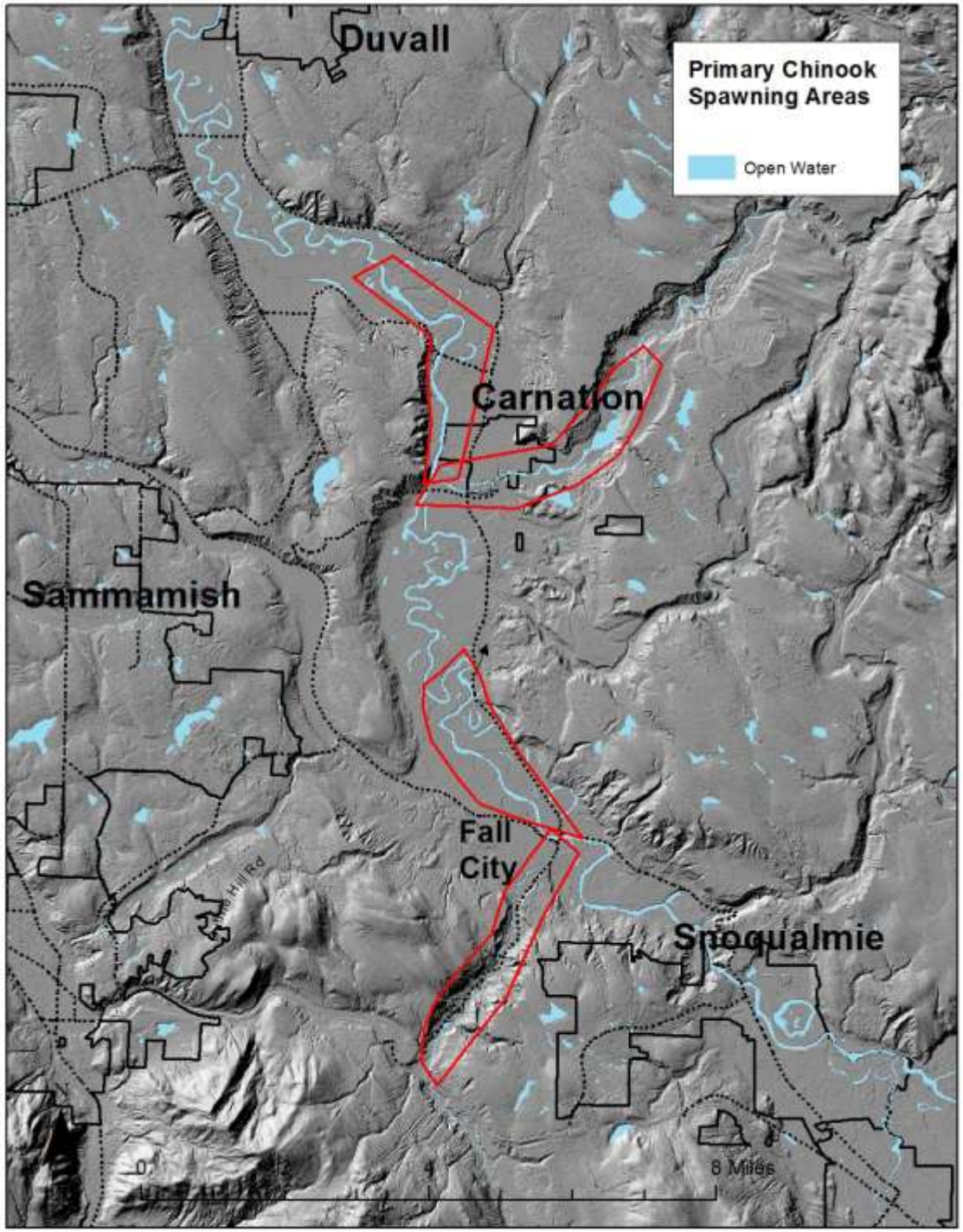
Chinook



From Field Identification of Coastal Juvenile Salmonids

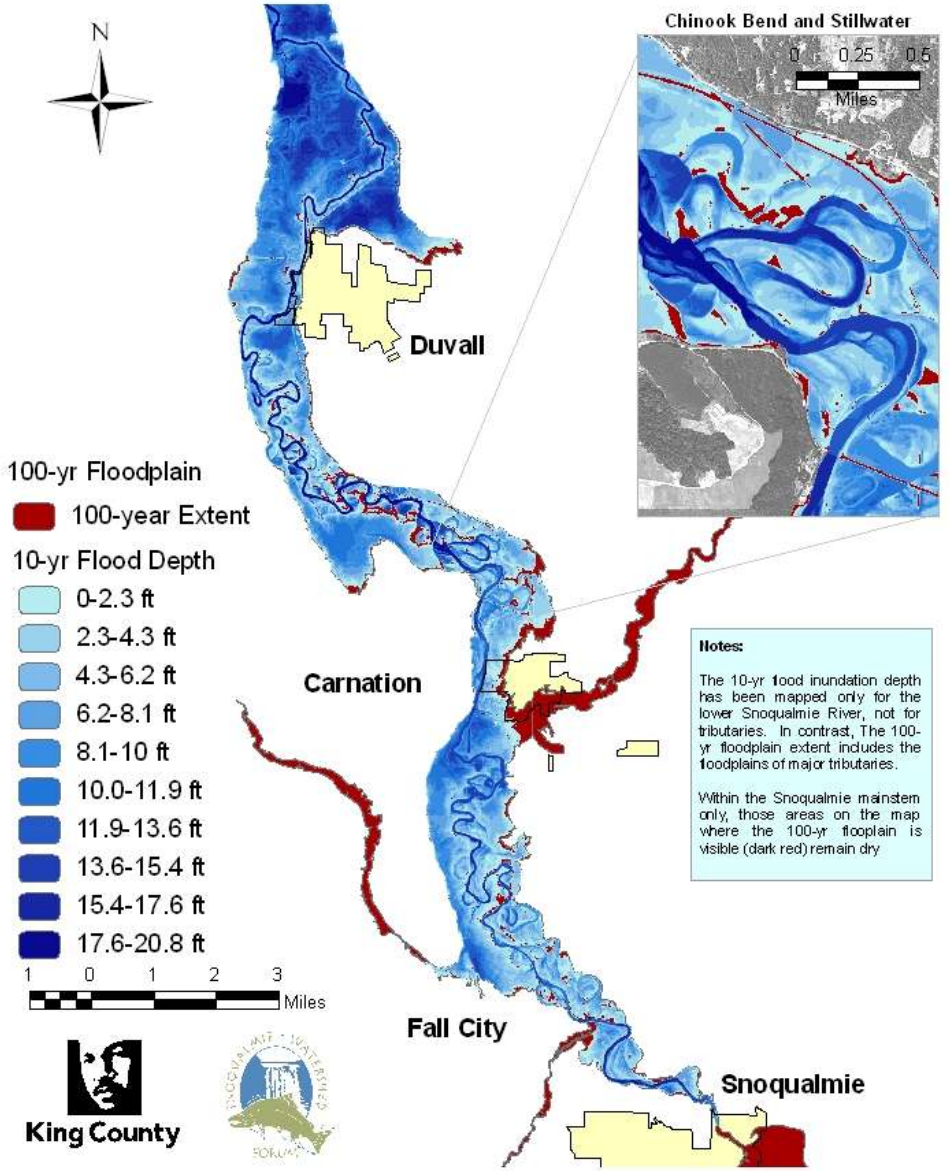
Timing


Salmon Timing in the Snohomish Basin
Species
Freshwater Life Phase
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
1-15 16-31
1-15 16-28
1-15 16-31
1-15 16-30
1-15 16-31
1-15 16-30
1-15 16-31
1-15 16-31
1-15 16-30
1-15 16-31
1-15 16-30
1-15 16-31
Summer/Fall Chinook
Upstream Migration
Spawning
Incubation
Juvenile Rearing
Juvenile Outmigration
Estuarine Residence Time
Majority rear until July; minority remain in system for the year.
Coho
Upstream Migration
Spawning
Incubation
Juvenile Rearing
Juvenile Outmigration
Estuarine Residence Time
Chum
Upstream Migration
Spawning
Incubation
Juvenile Rearing
Juvenile Outmigration
Estuarine Residence Time
Steelhead
Upstream Migration - summer
Upstream Migration - winter
Spawning - summer
Spawning - winter
Incubation
Juvenile Rearing
Smolt Outmigration
Estuarine Residence Time summer/winter
Pink
Upstream Migration
Spawning
Incubation
Juvenile Rearing
Juvenile Outmigration
Estuarine Residence Time
Coastal Cutthroat
Upstream Migration
Spawning
Incubation
Juvenile Rearing
Juvenile Outmigration
Estuarine Residence Time



- Spawning locations driven by geology
- Having multiple separate locations helps reduce catastrophic risk
- Historically spawning was likely more wide spread in to tributaries. Expect that again when Chinook numbers increase.

Lower Snoqualmie River 10-Year Flood Depth



Notes:

The 10-yr flood inundation depth has been mapped only for the lower Snoqualmie River, not for tributaries. In contrast, The 100-yr floodplain extent includes the floodplains of major tributaries.

Within the Snoqualmie mainstem only, those areas on the map where the 100-yr flooplain is visible (dark red) remain dry

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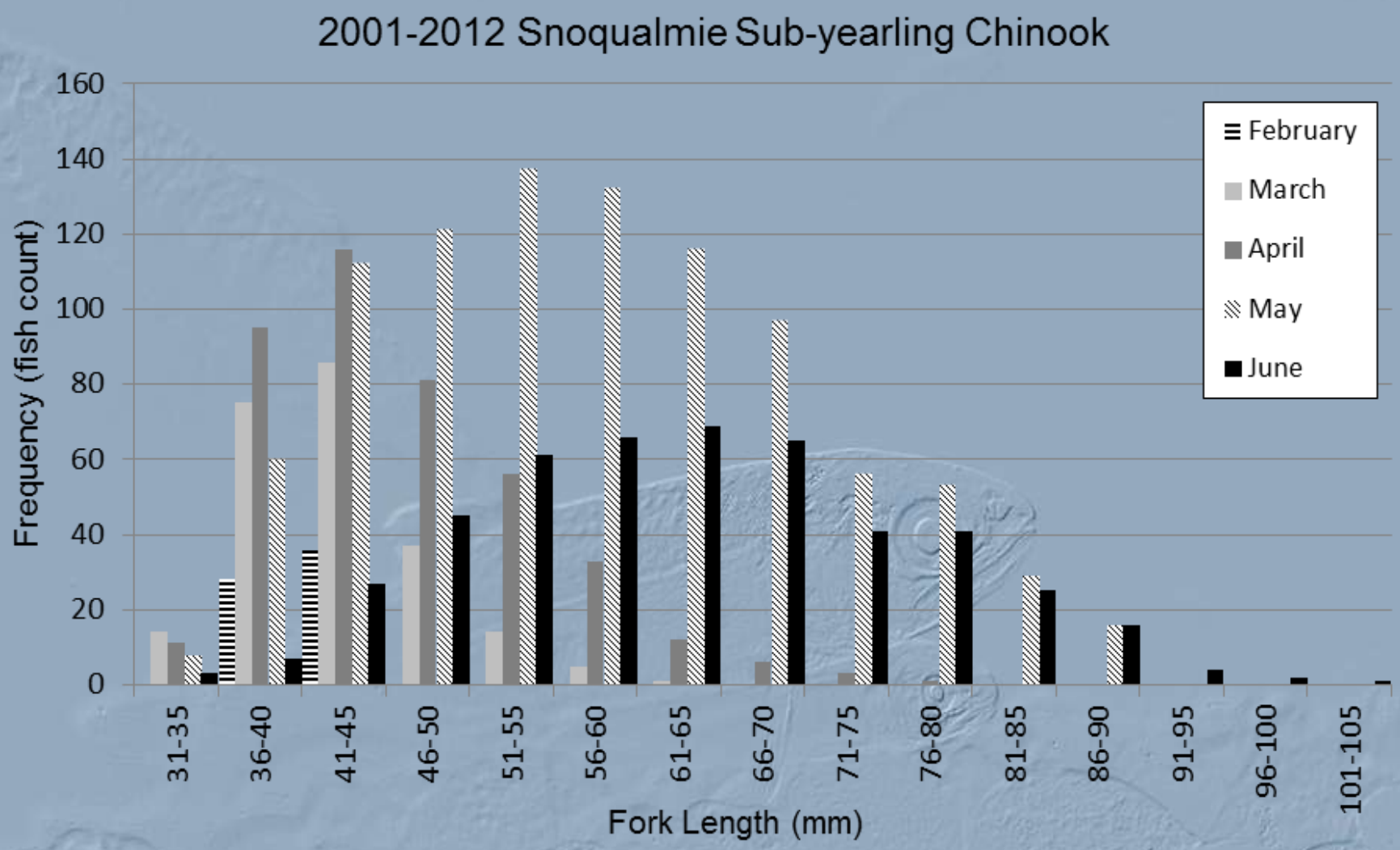
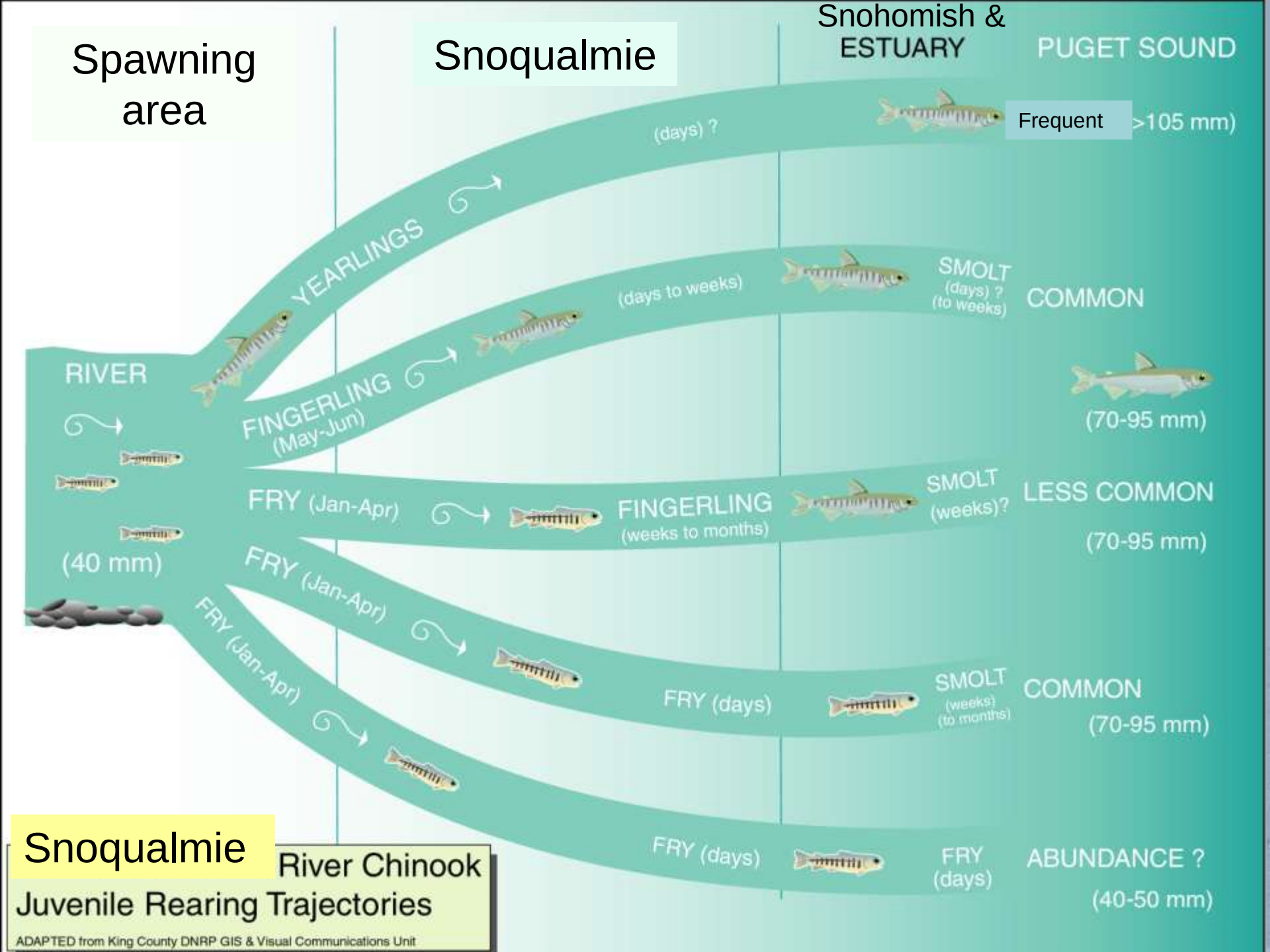
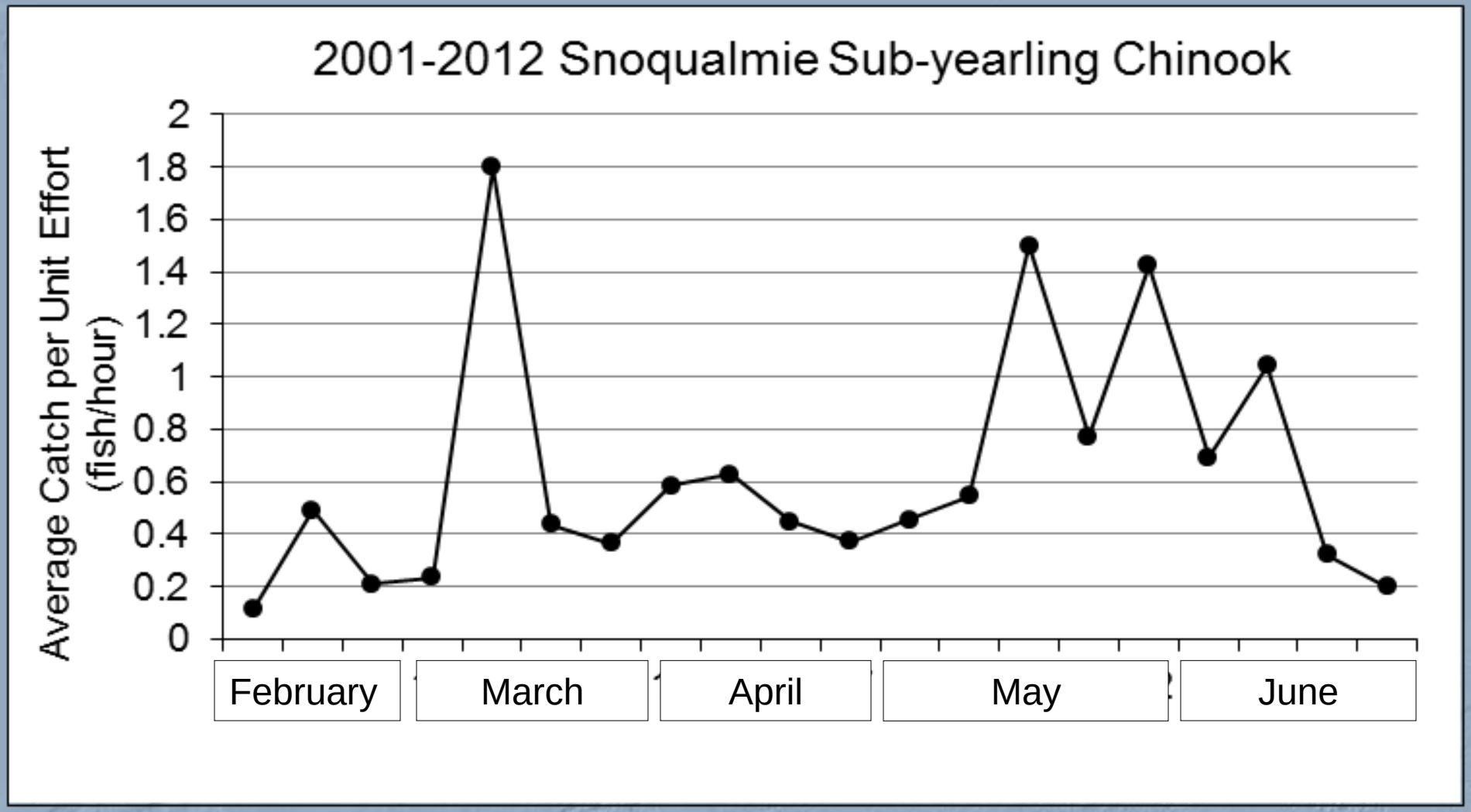
\\wlmt4\snoqualmie\GIS Discussions\10yrfloodata\Project files\TenYrFld_03.13.2007



Graphic from 2000-2012 Skykomish and Snoqualmie Rivers Chinook and Coho Salmon Out-migration Study Draft Report—From Tulalip Tribes


Spawning area
Snoqualmie
Snohomish & ESTUARY
PUGET SOUND
RIVER
(40 mm)
YEARLINGS
(days) ?
Frequent
>105 mm)
FINGERLING (May-Jun)
(days to weeks)
SMOLT (days) ? (to weeks)
COMMON
(70-95 mm)
FRY (Jan-Apr)
FINGERLING (weeks to months)
SMOLT (weeks)?
LESS COMMON
(70-95 mm)
FRY (Jan-Apr)
FRY (days)
SMOLT (weeks) (to months)
COMMON
(70-95 mm)
FRY (Jan-Apr)
FRY (days)
FRY (days)
ABUNDANCE ?
(40-50 mm)
Snoqualmie River Chinook
Juvenile Rearing Trajectories
ADAPTED from King County DNRP GIS & Visual Communications Unit



Graphic modified from 2000-2012 Skykomish and Snoqualmie Rivers Chinook and Coho Salmon Out-migration Study Draft Report. From the Tulalip Tribes.

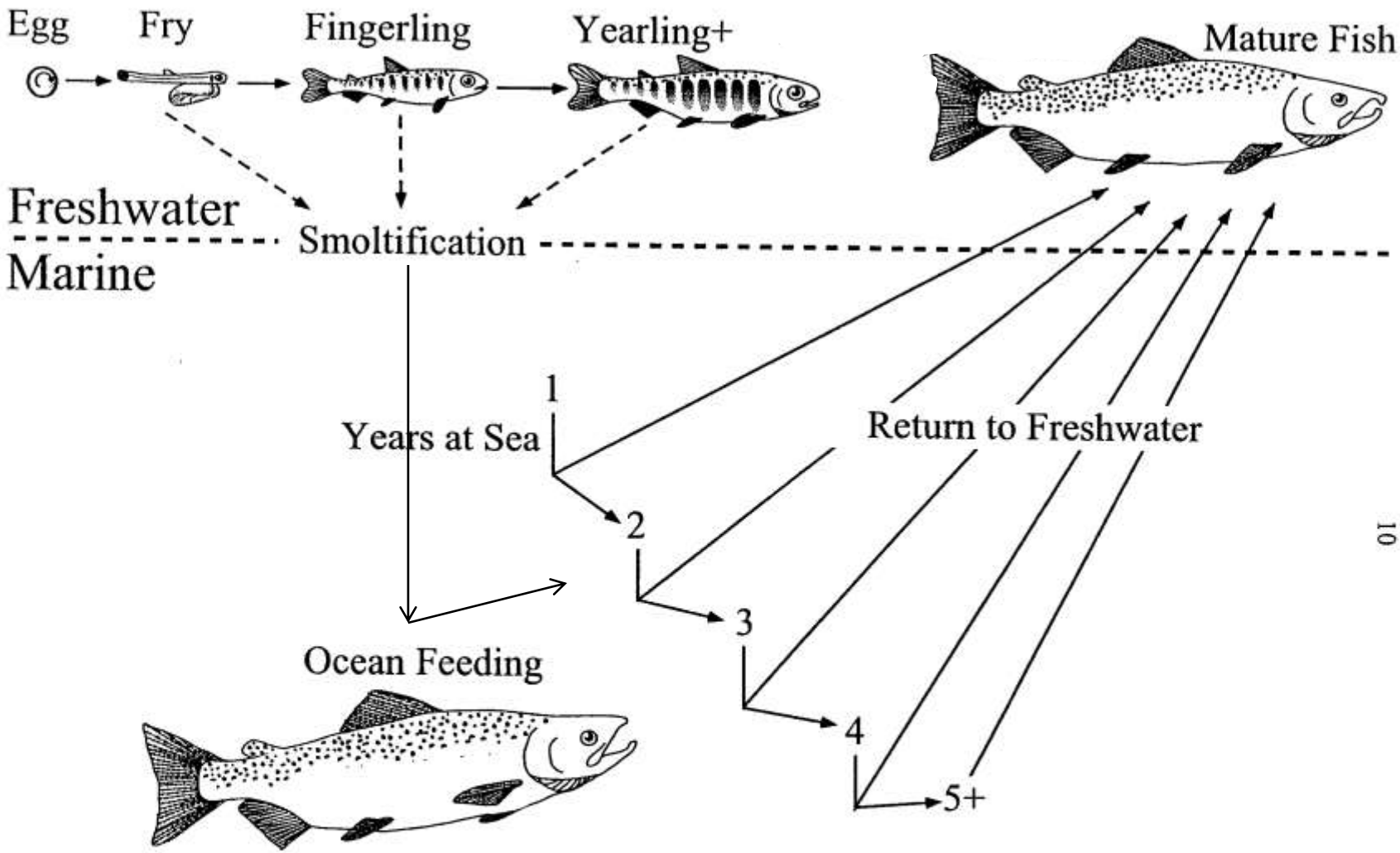
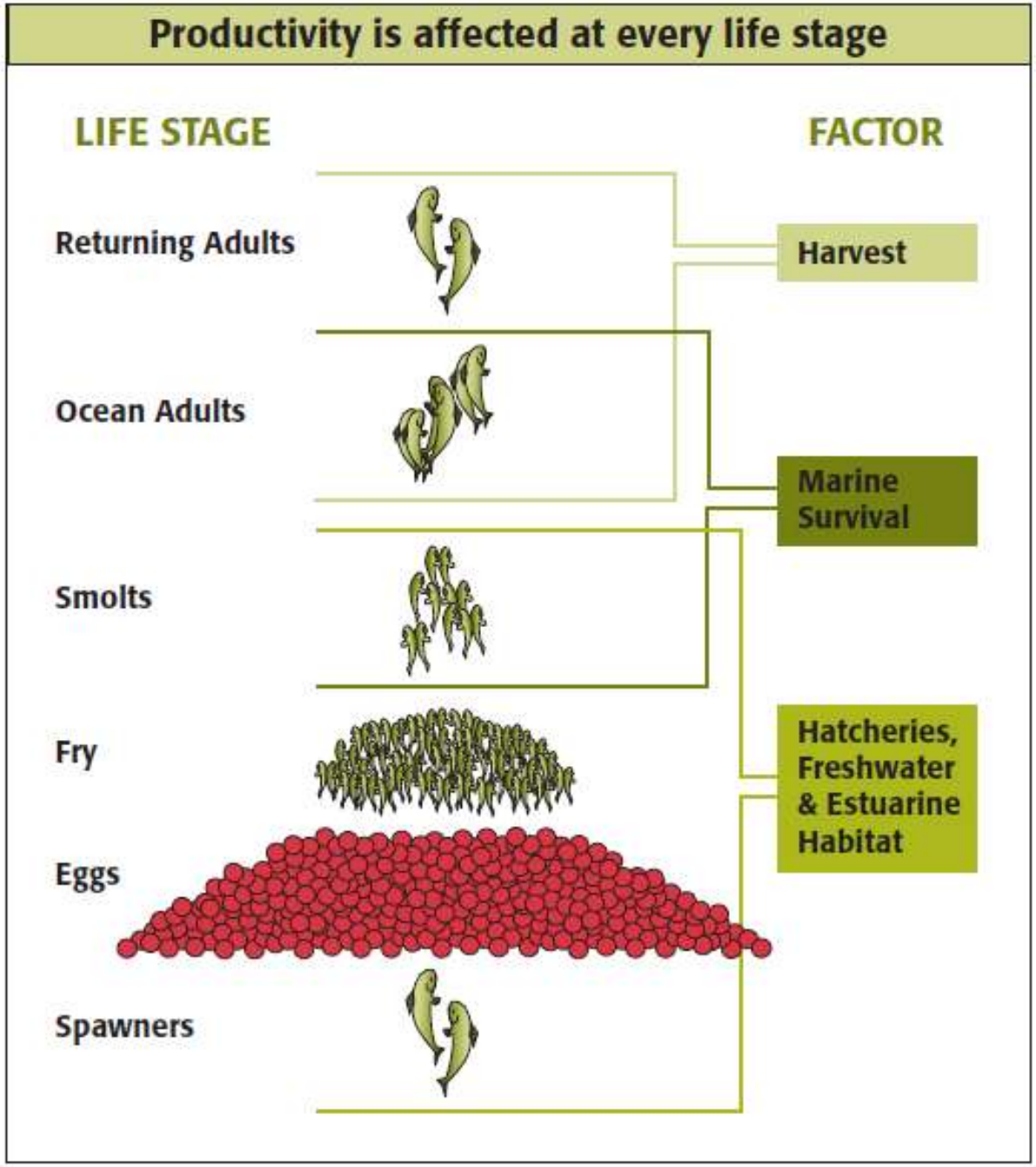


Figure 2. Diagram of potential smolting and maturation strategies utilized by chinook salmon.



(Source, WDFW & NWIFC)

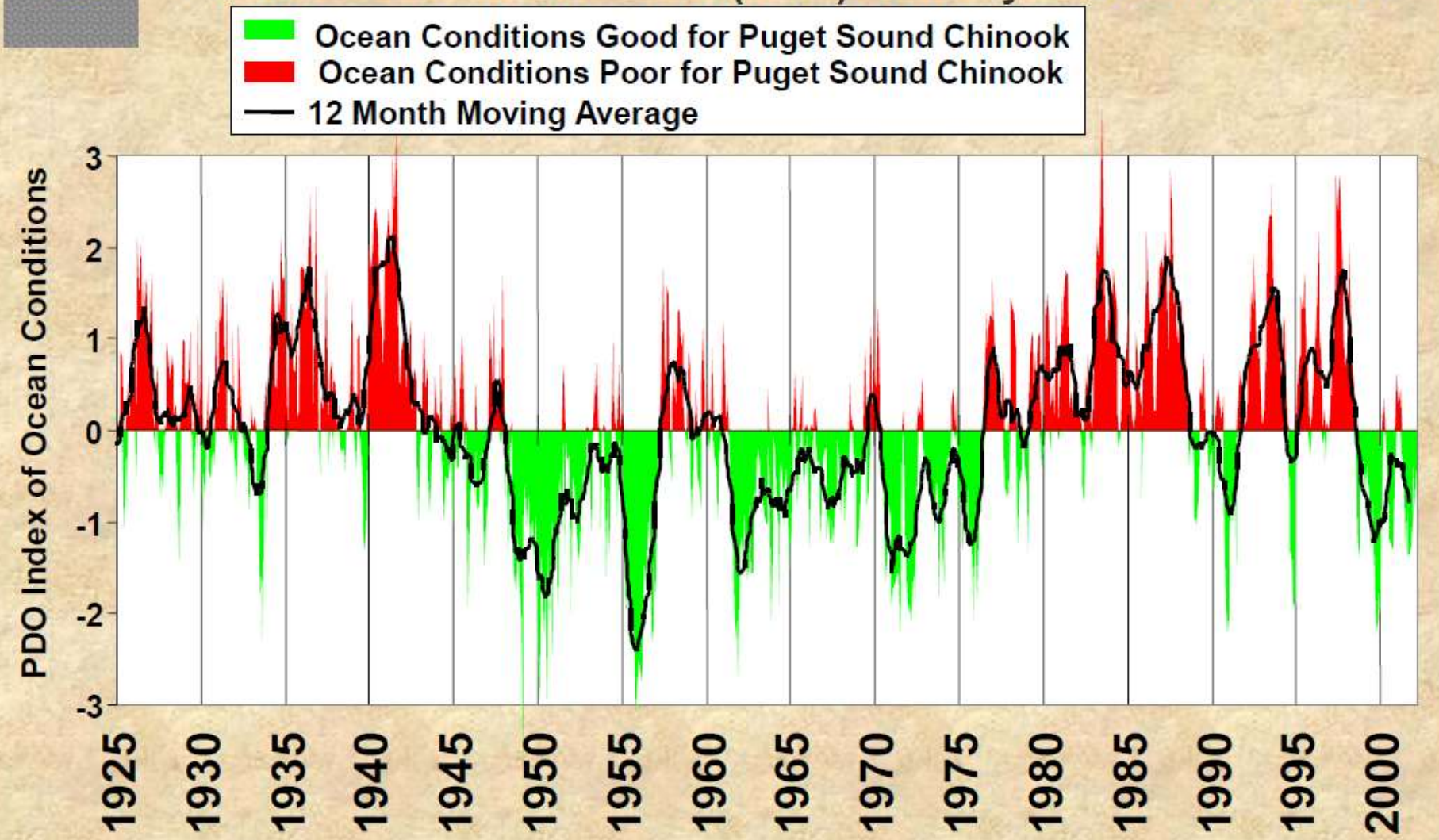
Figure 3.17 Salmon productivity is affected at every life stage.

1000 Spawners
1.0 Low productivity
1000 return

1000 Spawners
3.6 High productivity
3600 return

Constraints on Production of Adult Blackmouth

Pacific Decadal Oscillation (PDO) January 1925 - March 2002



Data Source: N. Mantua, University of Washington

Who’s present where in Agricultural Production District?

- Mile wide river bottom floodplain, mostly hyrdologically connected (few flood gates) + lots of spawning potential above Ag area
- Highly concentrated spawning areas for salmon (especially Chinook) in the middle of the Agricultural Production District
- Chinook and steelhead are found in small streams in Ag areas, but in much smaller numbers than coho/cutthroat

Who and where continued

- Coho salmon and cutthroat trout are found all over the basin—including the Agricultural Production District
- Chum and pink salmon are fairly rare in floodplain habitats due to their specific life history strategies
- Likely that at least one non-salmonid species will be present in most floodplain streams or ditches

BREAK

Drivers

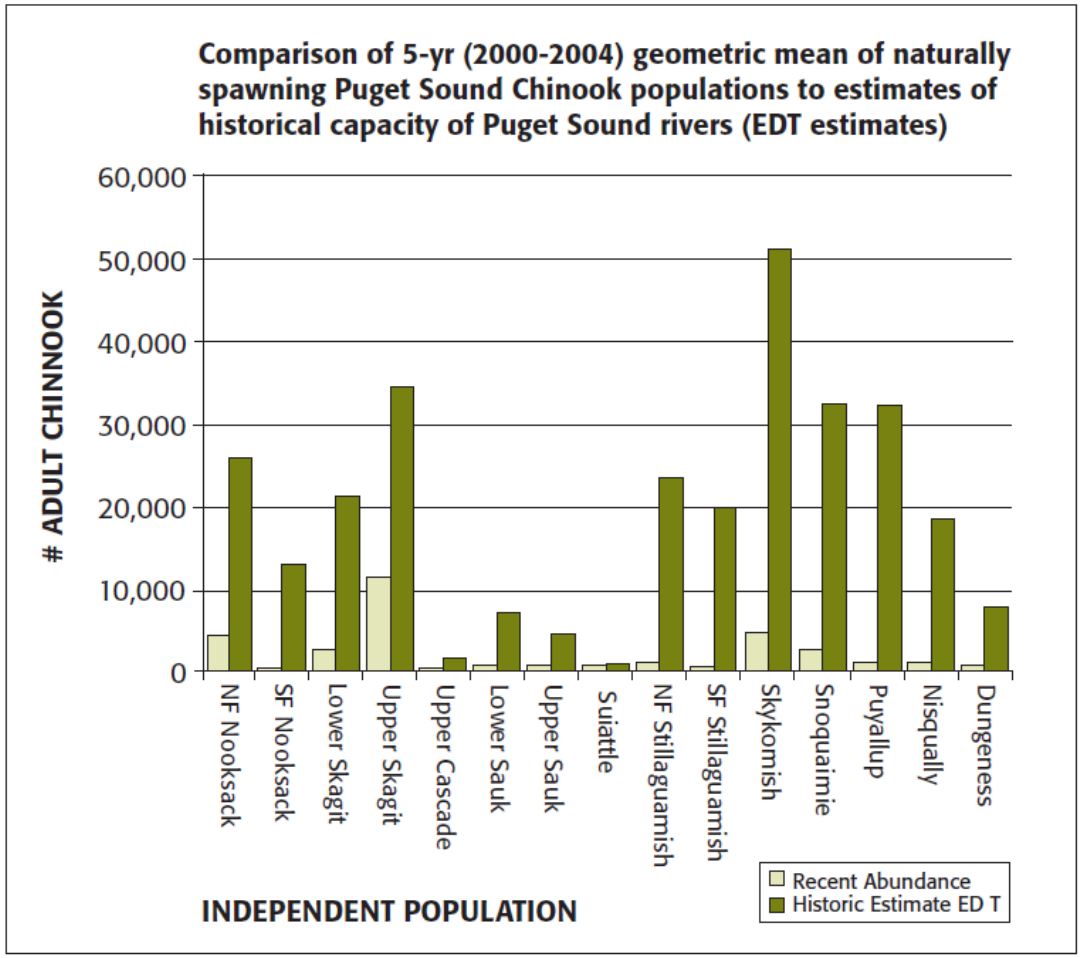
- Federal
  - Endangered Species Act (ESA)
    - Chinook listed 1998
    - Bull Trout listed1999
    - Steelhead listed 2007
  - Clean Water Act (Water Quality Regs)
- Tribal Rights
  - Co-manage harvest and hatcheries
- State
  - Co-manage harvest and hatcheries
  - Growth Management Act
  - Shoreline Management Act

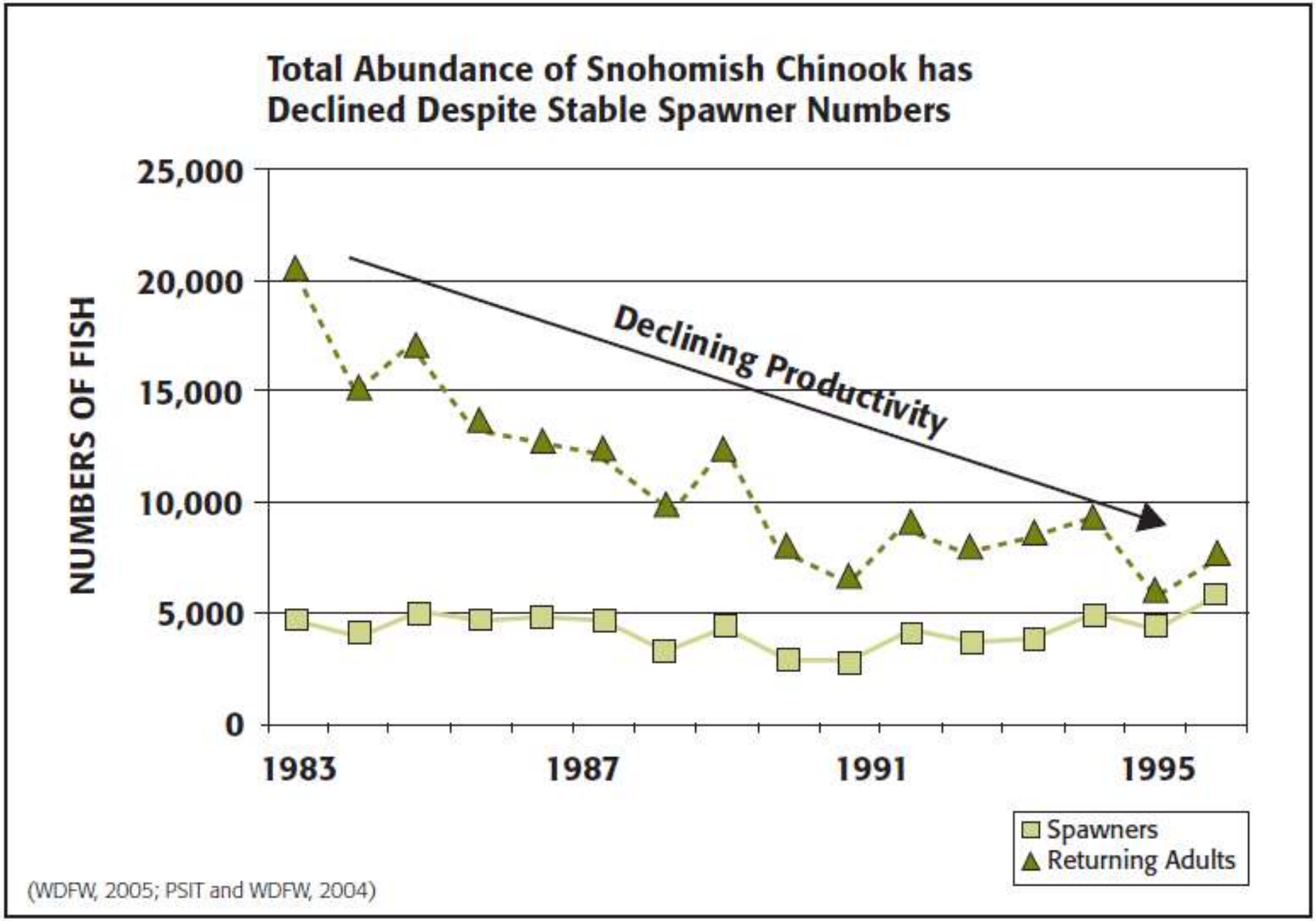
Why listed as threatened?

9 Puget Sound Chinook populations are believed to be extinct, including the early run population of the Snohomish

Snoqualmie Chinook population is ~ 5.7% of historic abundance

Skykomish Chinook population is ~3.4% of historic abundance




Total Abundance of Snohomish Chinook has Declined Despite Stable Spawner Numbers
NUMBERS OF FISH
25,000
20,000
15,000
10,000
5,000
0
1983
1987
1991
1995
Declining Productivity
Spawners
Returning Adults
(WDFW, 2005; PSIT and WDFW, 2004)

The habitat in the floodplain is in poor condition

- Watercourses and wetlands are channelized *(~64% channelized)*
- Historic floodplain wetlands are gone *(~81%)*
- Riparian vegetation is relatively rare and where present very sparse (*63% of 150ft buffer on the Snoqualmie lacks trees*)
- Temperature tends to be too high
- Instream conditions are simplified & off channel habitat lacking *(40% banks armored)*
- Flows are modified from historic conditions

Response to ESA Listing

- Planning effort across Puget Sound
- Wanted local vs federal control
- Each major watershed undertook separate planning effort
- Culminated in regionally rolled up habitat recovery plan, with individual watershed chapters in 2005

Snohomish Basin (WRIA 7)

Snohomish Basin Salmon Recovery Forum

- Lead entity for Snohomish Basin
- Oversee implementation basin Salmon Plan
- Based out of Snohomish County

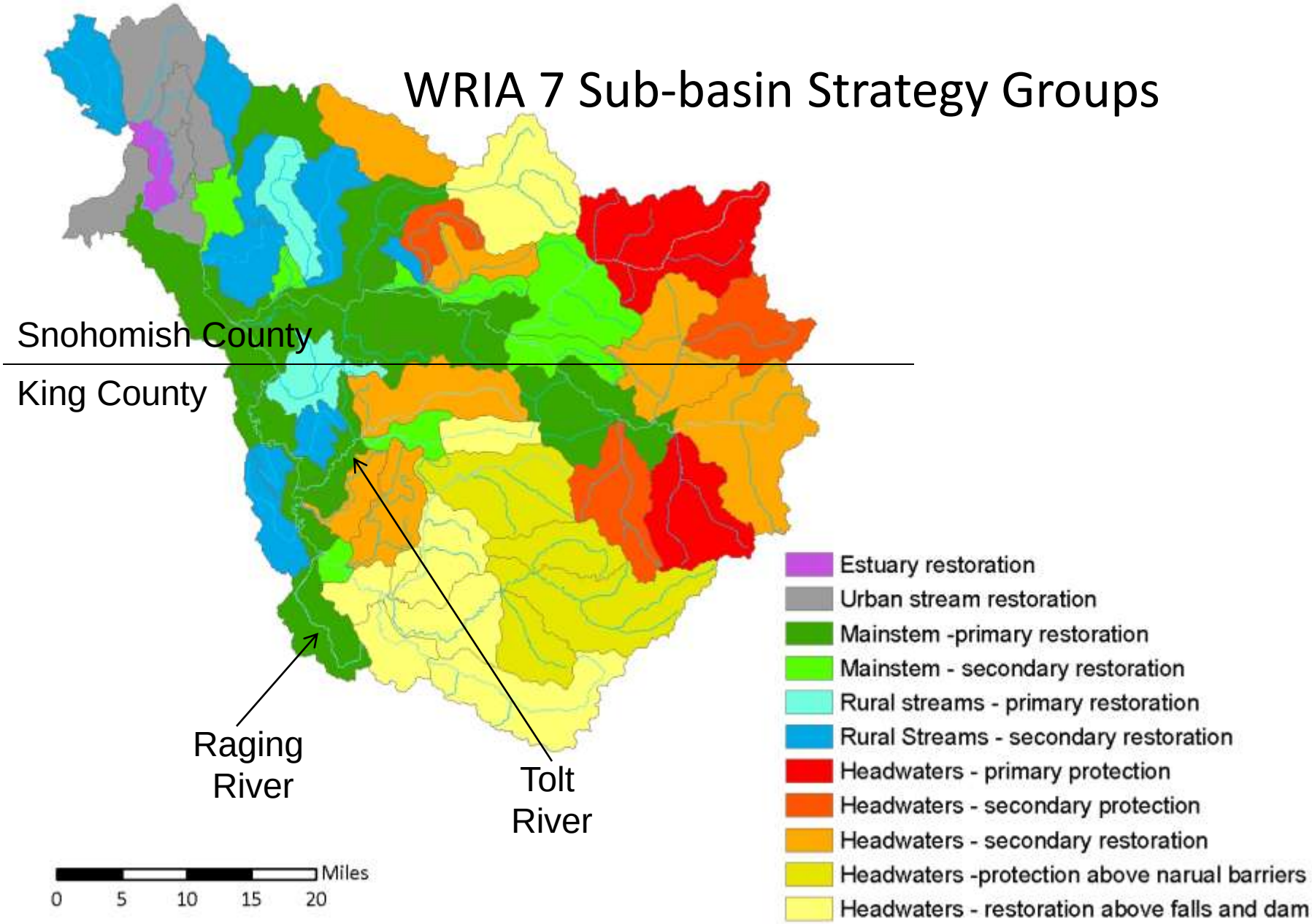
Snoqualmie Watershed Forum

- Partnership between King County, 4 cities of Snoqualmie Valley and Snoqualmie Tribe
- Coordinate on salmon recovery and broader water issues in King County portion of basin
- Work hand-in-hand with Snohomish Forum

Habitat Assumptions & Approach

- Human population will grow, mainly in cities. Some degradation expected
- Protection: Intact hydrologic, sediment and riparian processes most important
- Restoration: Chinook juvenile rearing habitat most important
  - Mainstem rivers, estuary, nearshore
- Minimize losses (protection) and make gains (restoration) in other areas
  - Rural tributaries, headwaters, urban streams

WRIA 7 Sub-basin Strategy Groups



Plan Focus

- Dedicate resources-80% mainstems, 15% rural streams, 5% headwaters (first 10 yrs)
- Restoring ecosystem processes vs. structure
- Keep harvest rates low in the near term
- Strong focus on rearing habitat (50 yr goals)
  - Off channel habitat target-reconnect 50 to 80%
  - Edge habitat target-80 to 90% natural banks
  - Instream wood target-80% have proper amounts

Plan Focus

- Basin wide focus (50 yr goals)
  - Forest cover—Target is 65 to 75%
  - Impervious surface—Target is less than 7%
  - Culverts/fish blockages—Target is 95% of the length of blocked habitat opened up

Salmon Plan & Ag

"The Forum recommends a comprehensive and cooperative approach to working with willing agriculture landowners on habitat protection and restoration, including:"

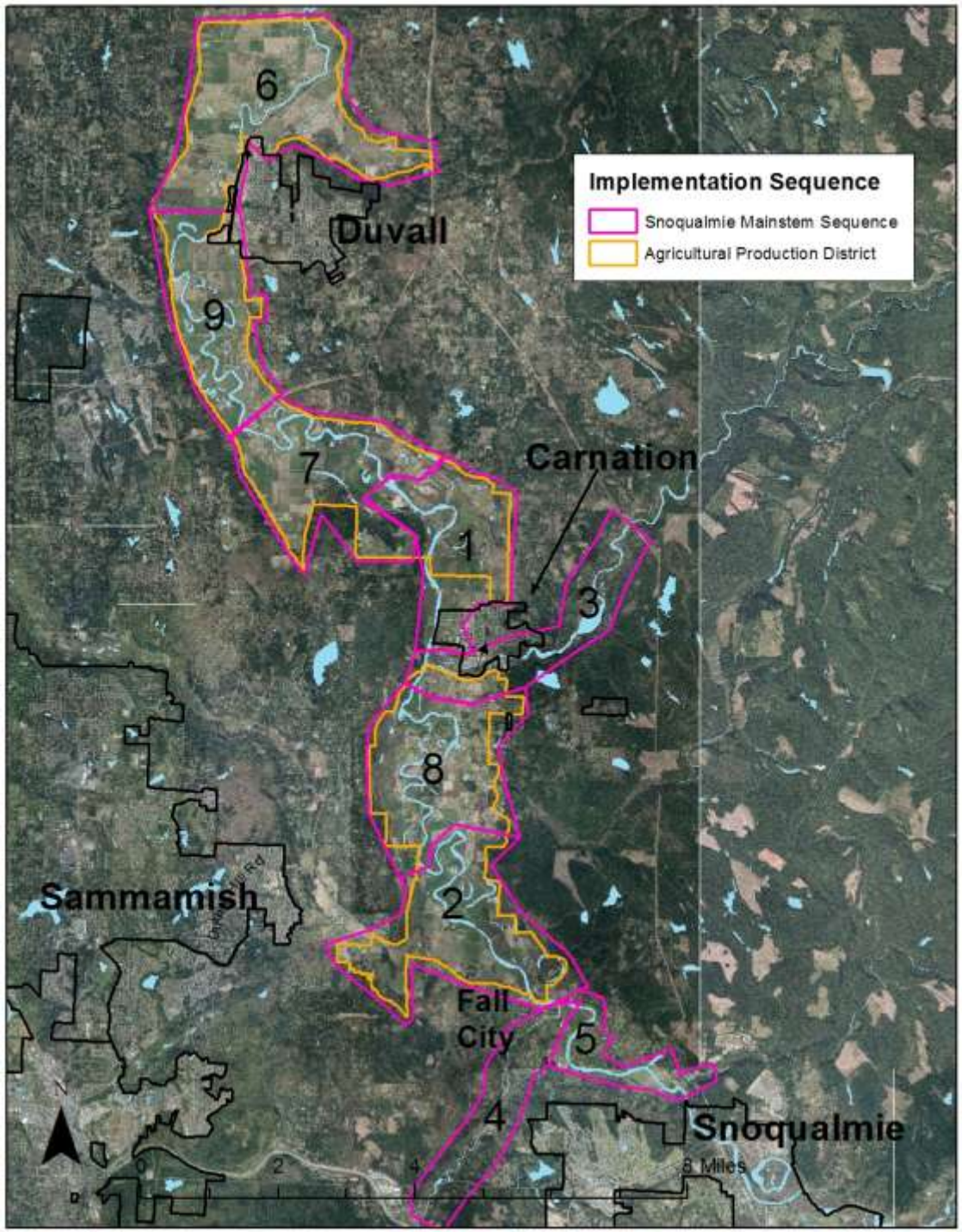
- Supporting viable agriculture
- Recognizing the initiative and expertise of the farming community
- Protecting intact habitat
- Providing technical assistance for on-the-ground projects
- Encouraging the use of incentives
- Working cooperatively to identify and implement solutions

Sequencing

- Public lands first
  - 80% of the land on the Snoqualmie River is privately owned. When possible implement large capital projects on public lands first.
- Ag lands

1) Focus on unmanaged and marginal lands,
2) Work on <u>non</u>-Farmlands Preservation Properties (FPP) lands
3) Work on Farmlands Preservation Properties lands

Implementation Sequence



For the next 10 years, it is recommended that projects be sequenced across geographic areas of the Snoqualmie

Plan priority action sequence for Snoqualmie mainstem

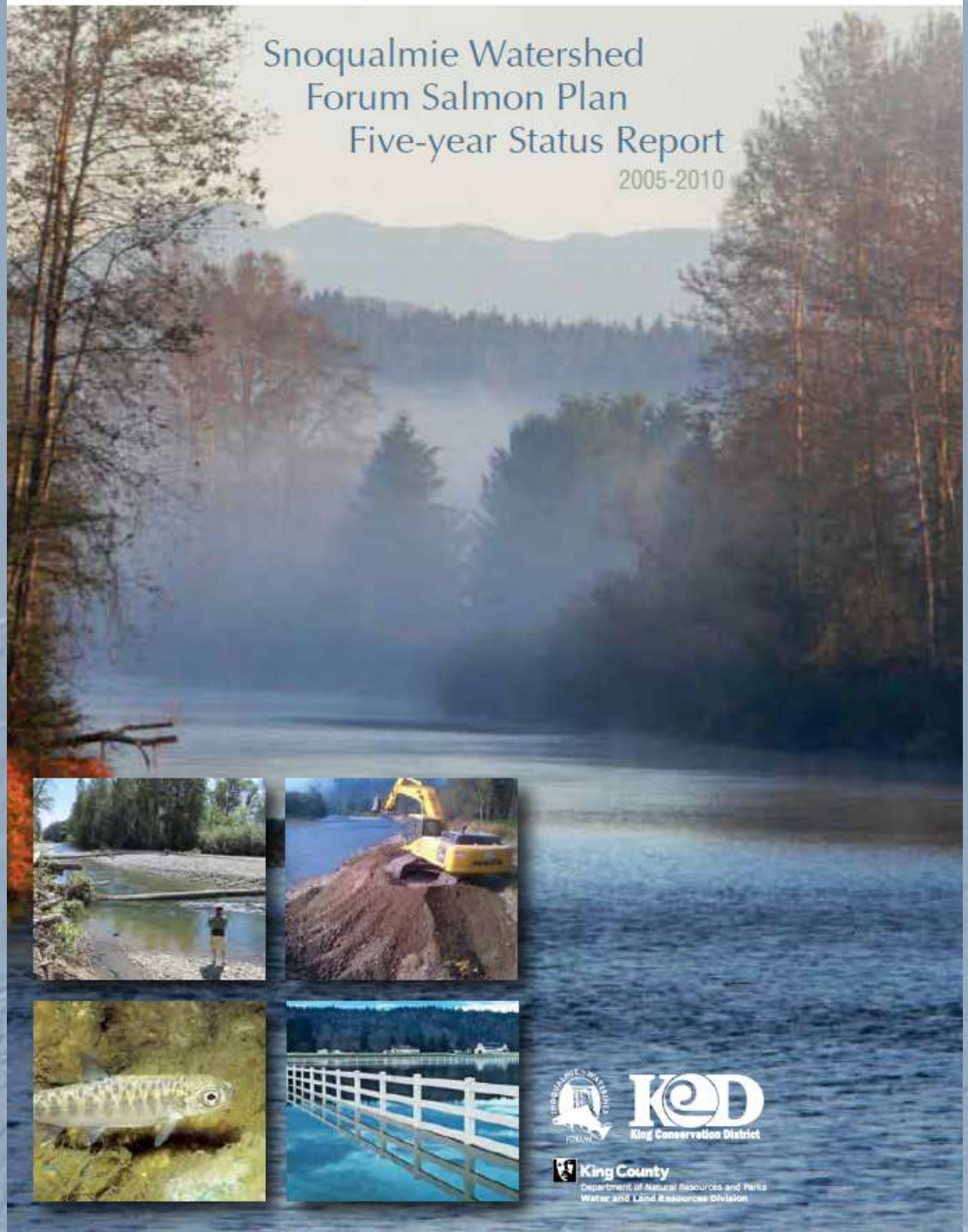
1st Tier

1. Preserve/protect habitat
2. Reconnect off channel habitats
3. Restore shoreline/edge conditions
4. Restore hydrologic processes
5. Restore riparian areas

2nd Tier

6. Restore instream passage barriers
7. Address water quality issues
8. Instream wood enhancement

- Next few slides come from this report
- It is available on-line
- If people are really interested can also get some hardcopies at next meeting



First Tier 10-year Goals (5 year progress report)

Sub-basin Strategy Group and Habitat	10 Year Habitat Goals	2005-2010 Progress
Nearshore Beaches and Shoreline	At least 1 mile	0.2 mile (20%)
Estuary: Restored Tidal Marsh	1,237 acres	375 acres (30%)
Mainstem: Restored Edge Habitat (King County Portion)	5.2 miles	1 mile (19%)
Mainstem Restored: Off-Channel Habitat (King County Portion)	84 acres	21 acres (25%)
Mainstem: Restored Riparian Habitat (King County Portion)	128 acres	81 acres (63%)
Mainstem: Large wood (King County Portion)	20 jams	8 jams (40%)

Acres planted

- Mainstem 1° = Snoqualmie, Lower Tolt, Raging, SF Sky
- <u>Goals are NET gains</u>
- 10-year goals are 20% of 50-year goals
- Actions are investments in long-term processes
- Goals overly simplified in plan (there's more under the hood)

Second Tier 10-Year Goals (5 year progress report)

Sub-basin Strategy Group and Habitat	10 Year Goals	2005-2010 Progress
Mainstem Secondary: Riparian Restoration*#	3 acres	0 acres
Mainstem Secondary: Off-channel habitat*	3 acres	0 acres
Rural Primary: Riparian Restoration*#	7 acres	0 acres
Rural Primary: Off-channel Habitat*	5 acres	0 acres
Rural Secondary: Off-channel Habitat*	21 acres	0 acres
Rural Secondary: Riparian Restoration#	No target defined	11.4 acres

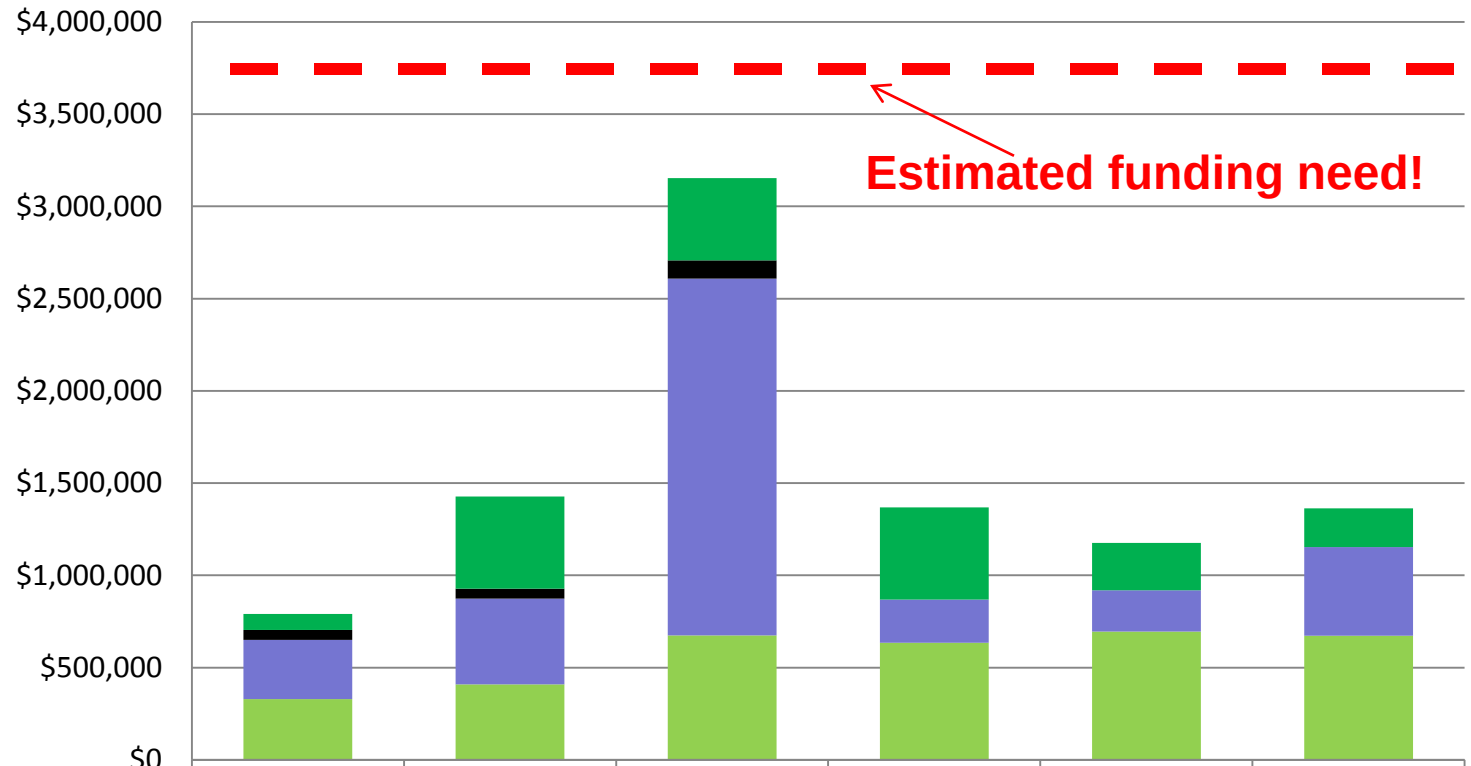
Snoqualmie from falls to Fall City & SF Tolt below dam

Cherry Creek

Harris, Ames, Patterson Creeks

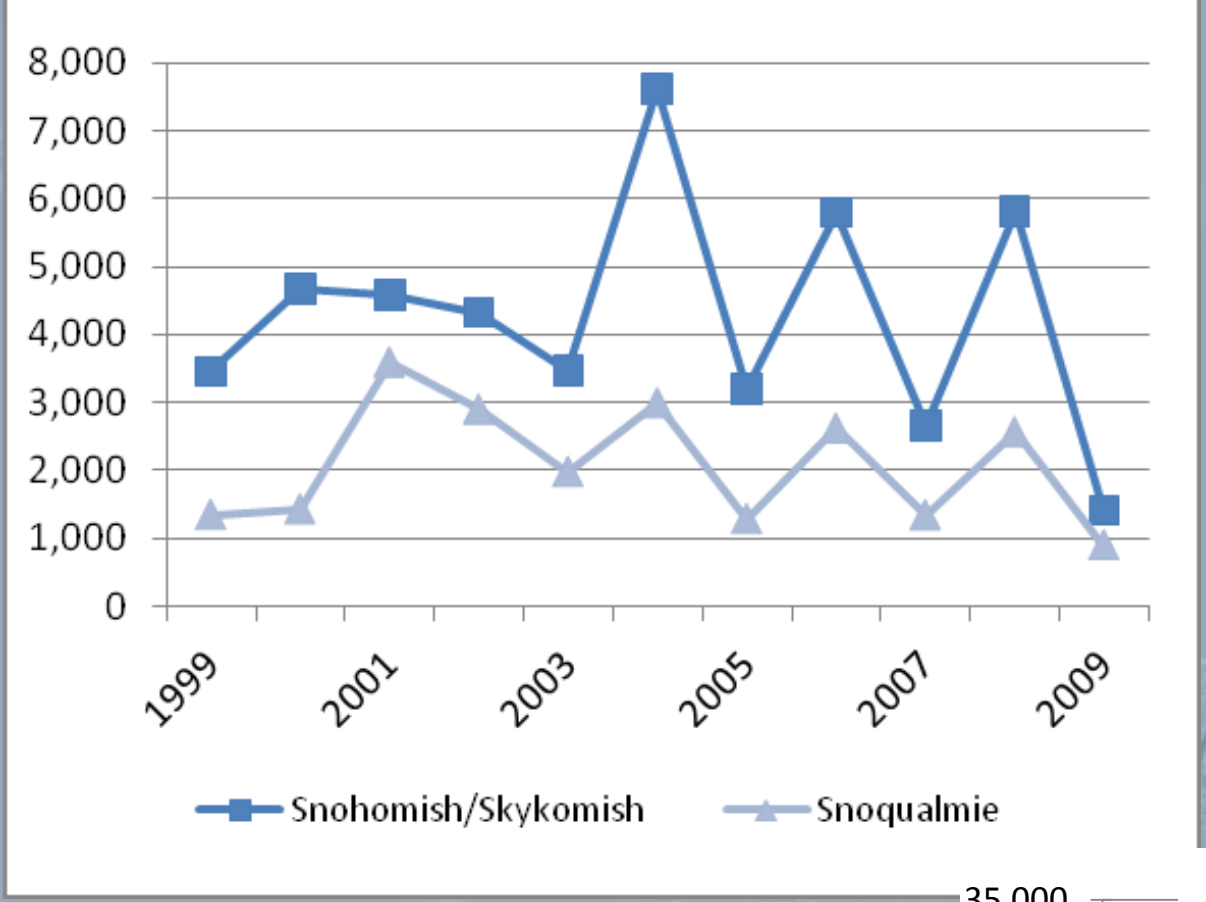
Restoration funding

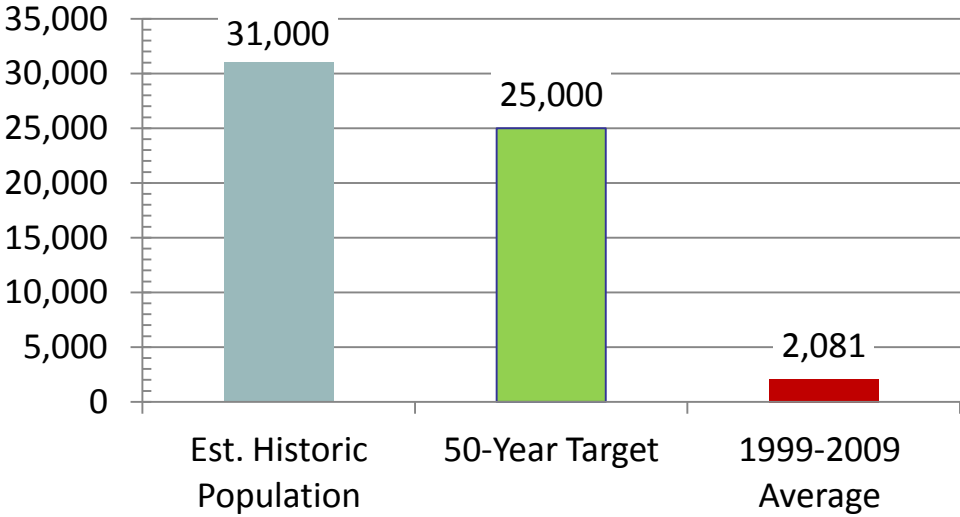
(does not include acquisition, noxious weed fund)



	2005	2006	2007	2008	2009	2010
KC SWM	$87,306	$500,000	$446,374	$500,000	$255,720	$210,000
CSF	$54,270	$54,500	$99,163	$0	$0	$0
SRFB/PSAR	$320,000	$465,000	$1,933,738	$233,340	$224,300	$480,296
KCD	$330,000	$408,463	$674,000	$635,000	$695,000	$673,000

Recent Chinook Abundance





BREAK

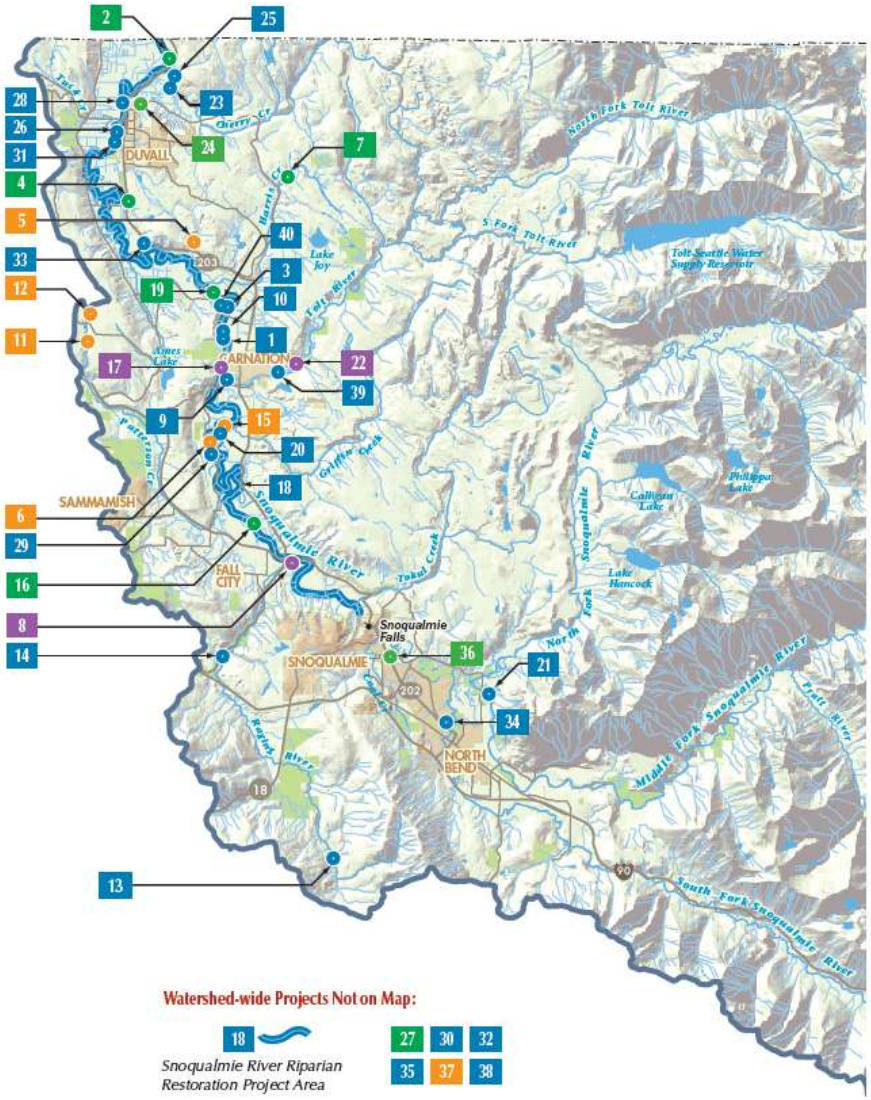
Projects, Opportunities and Challenges

- Large project examples
- Floodgates
- Irrigation
- Ag drainage
- Re-meandering small streams
- Buffers
- Large wood

PROGRESS ON EARLY ACTION HABITAT RESTORATION PROJECTS (2006-2012)*

Snoqualmie/Skykomish Watershed, King County

*Projects identified in Snoqualmie 2015 Report



Habitat Restoration Projects Led by King County

with project number and name

1. Camp Gilead Off Channel Reconnection
2. Cherry Creek Mouth Restoration
3. Chinook Bend Reach Restoration
4. Deer Creek Channel Relocation
5. East Fork Weiss Creek Fish Passage Improvement
6. Gonneson Revetment Removal
7. Harris Creek Tributary Fish Passage Improvement
8. Lower Raging River Restoration
9. Lower Tolt River Floodplain Reconnection
10. McElhoe/Pearson Backwater Restoration
11. NE 52nd Place Fish Passage Improvement
12. NE 67th Place Fish Passage Improvement
13. Raging River Kerriston Reach Restoration
14. Raging River Preston Reach Restoration
15. Snoqualmie River Byers Riparian Restoration
16. Snoqualmie River Fall City Reach Reconnection
17. Snoqualmie River Footbridge Off Channel Reconnection
18. Snoqualmie River Riparian Restoration
19. Stillwater Habitat Restoration
20. Stout Property Riparian Restoration
21. Three Forks Natural Area Restoration
22. Tolt River Natural Area Floodplain Reconnection

Habitat Restoration Projects Led by Other Organizations

with project number and name

23. Cherry Creek Floodplain Restoration
24. Cherry Valley Dairy Stream Enhancement
25. Cherry Valley Pump and Flood Gate Facility
26. Coe-Clemons Creek Restoration
27. Conservation Reserve Enhancement Program (CREP) Plantings
28. HerbCo Farm
29. Jubilee Farm Riparian Restoration
30. Lower Snoqualmie Restoration and Maintenance
31. McCormick Park Restoration
32. Middle Fork Snoqualmie River Valley Invasive Weed Removal Project
33. Oxbow Farm Channel Enhancement
34. Ribary Creek Restoration
35. Salmon-Safe Certification and Marketing
36. Sandy Cove Park Restoration
37. Shared Goats for Snoqualmie Salmon
38. Snoqualmie Tribal Community Conservation Corps
39. Tolt River Restoration
40. Wetlands Enhancement & Creation at Chinook Bend Natural Area

- Completed Project
- In Progress
- Scoping
- Rescoped or Cancelled
- Stream/River
- Watershed Boundary
- Major Road
- County Boundary
- Lake
- Incorporated Area
- King County Owned Properties

Watershed-wide Projects Not on Map:

18 — *Snoqualmie River Riparian Restoration Project Area*

27 30 32 35 37 38

N

0 1 2 3 4 8 Miles

November 2012

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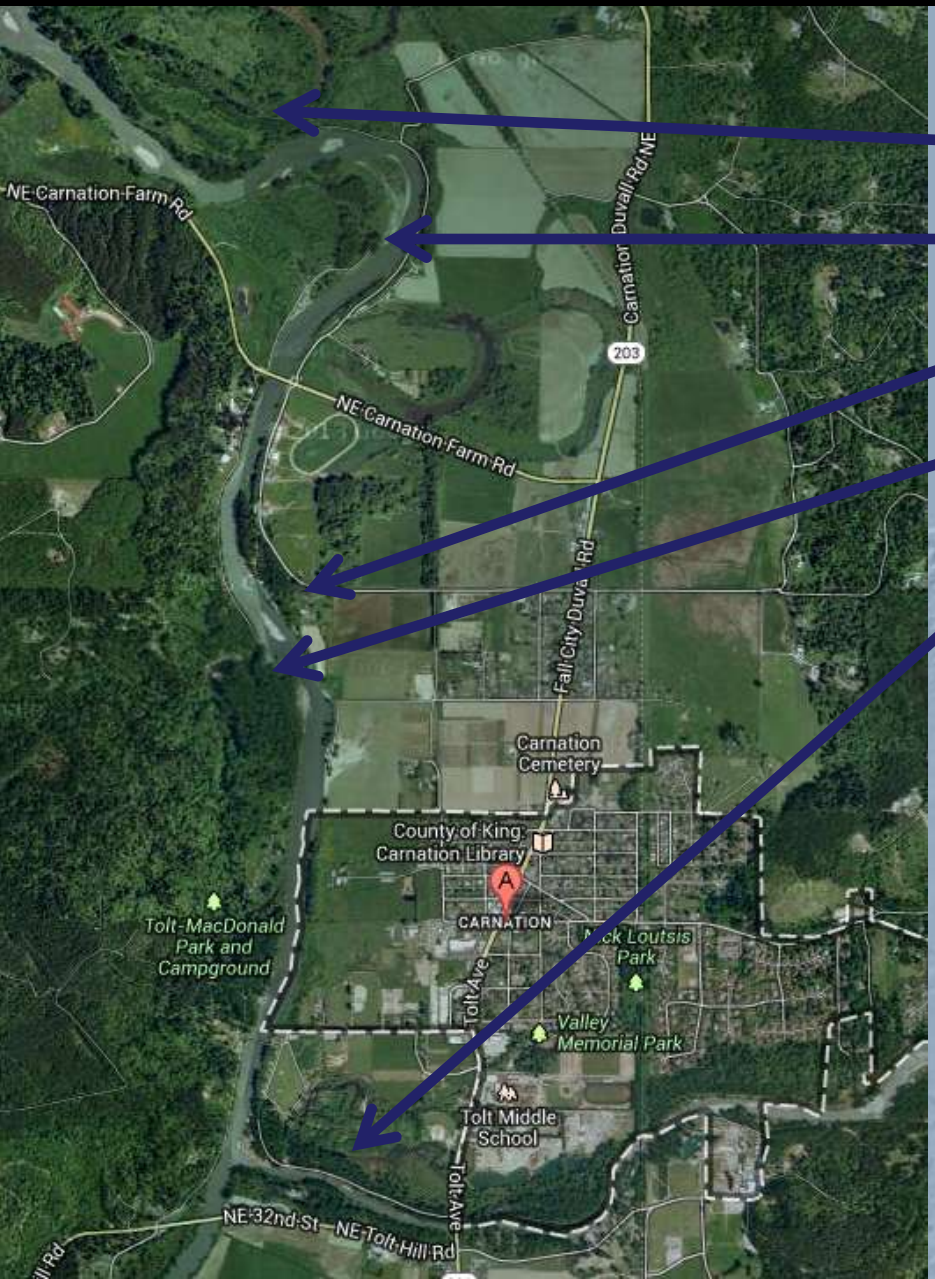
King County

Department of Natural Resources and Parks
Water and Land Resources Division

Recent Large projects



Stillwater

Chinook Bend

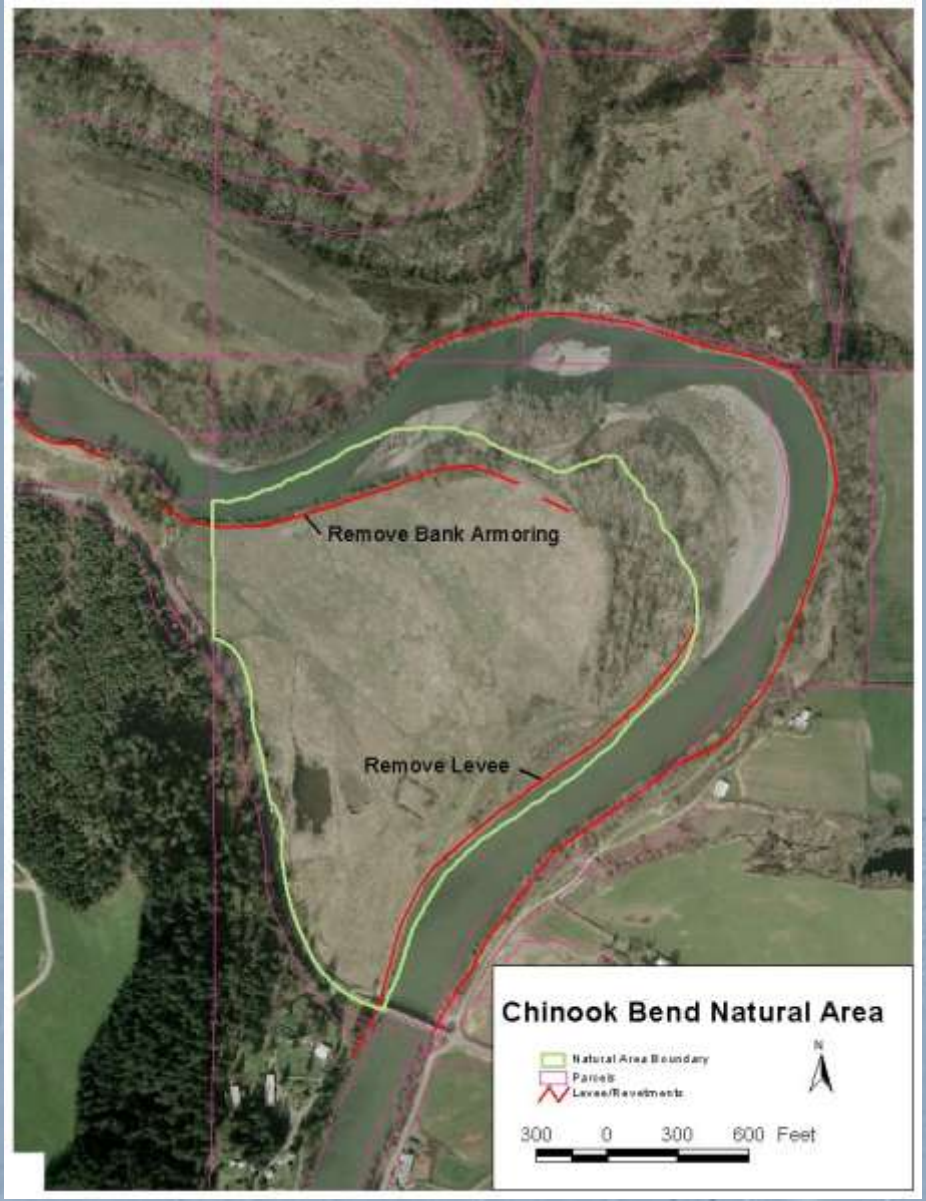
McElhoe-Pearson

Gilead

Lower Tolt

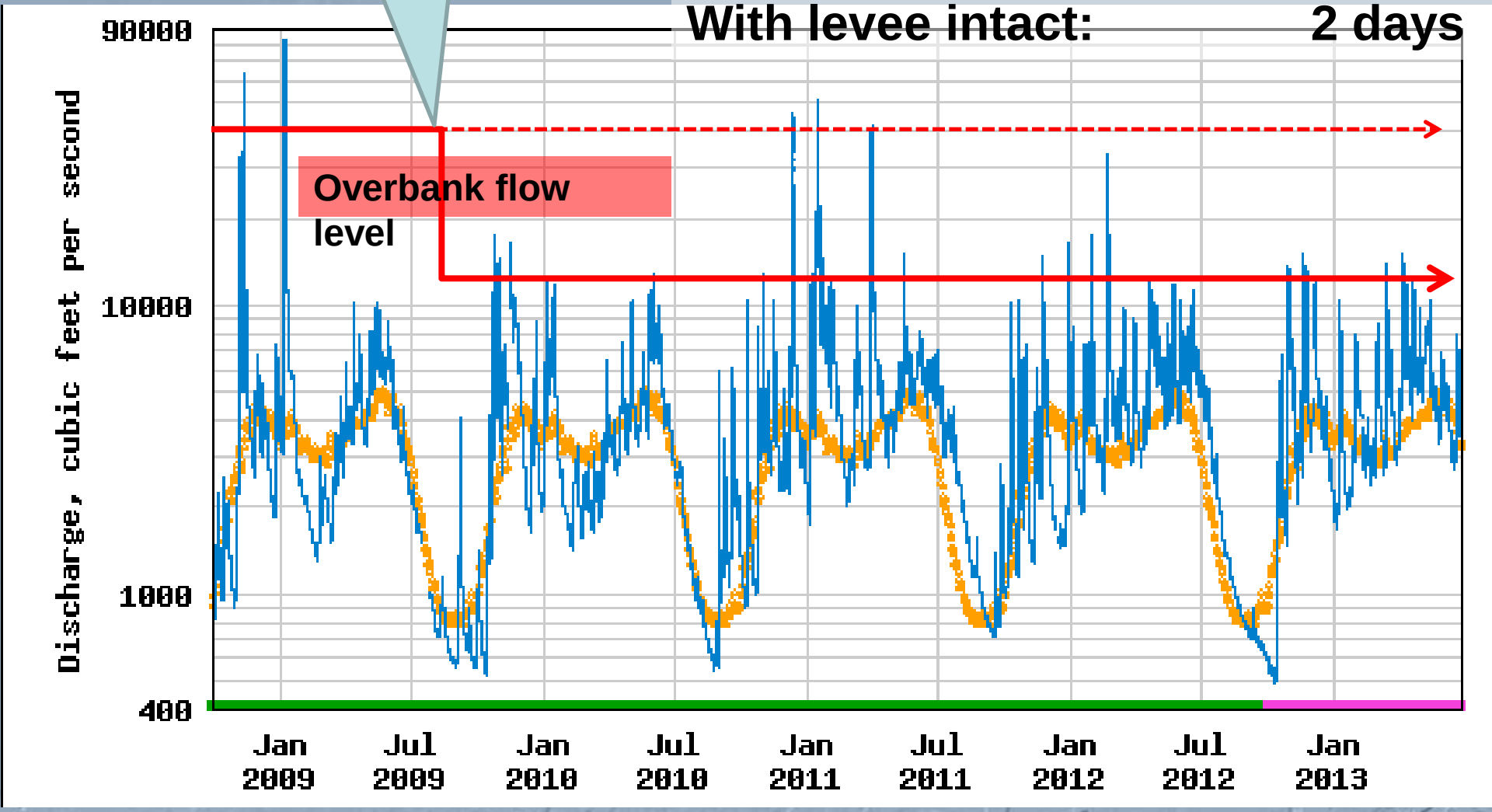
- Follows Forum sequence
- Mostly on public lands
- Out of the Ag District or not on active Ag lands

Chinook Bend Levee Removal

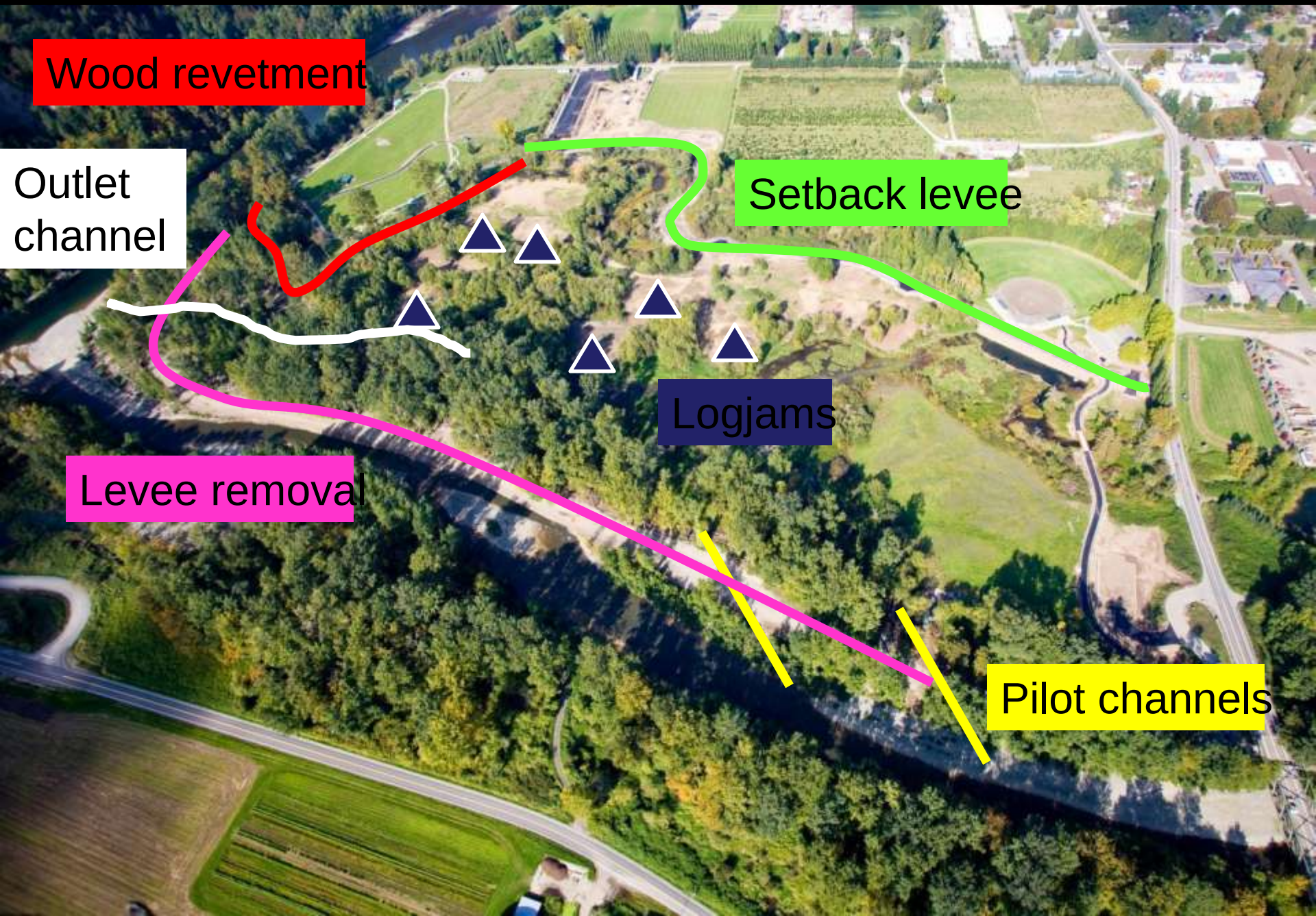


Process-based Restoration

Effect on Floodplain Connectivity



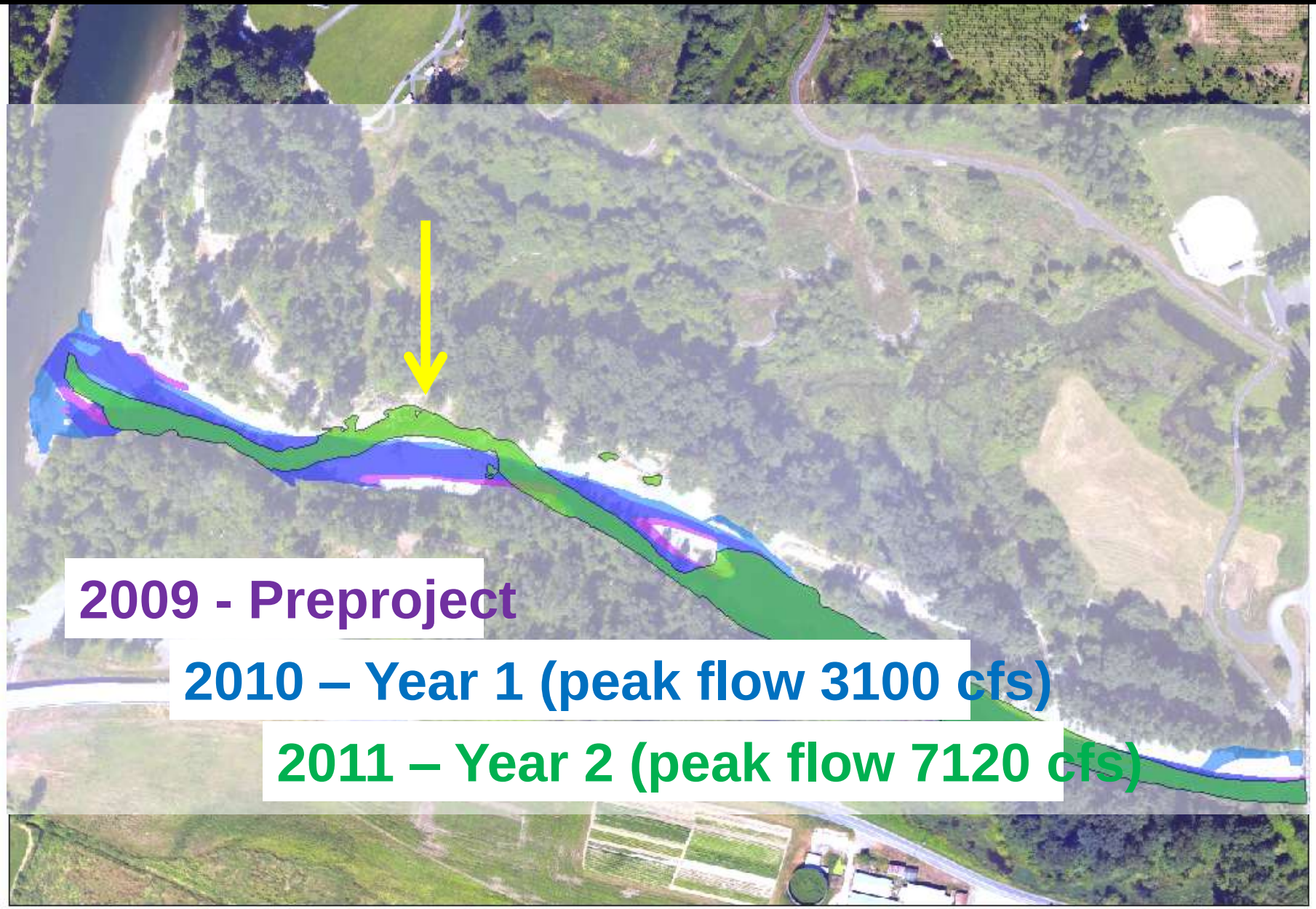
Lower Tolt Floodplain Reconnection Project



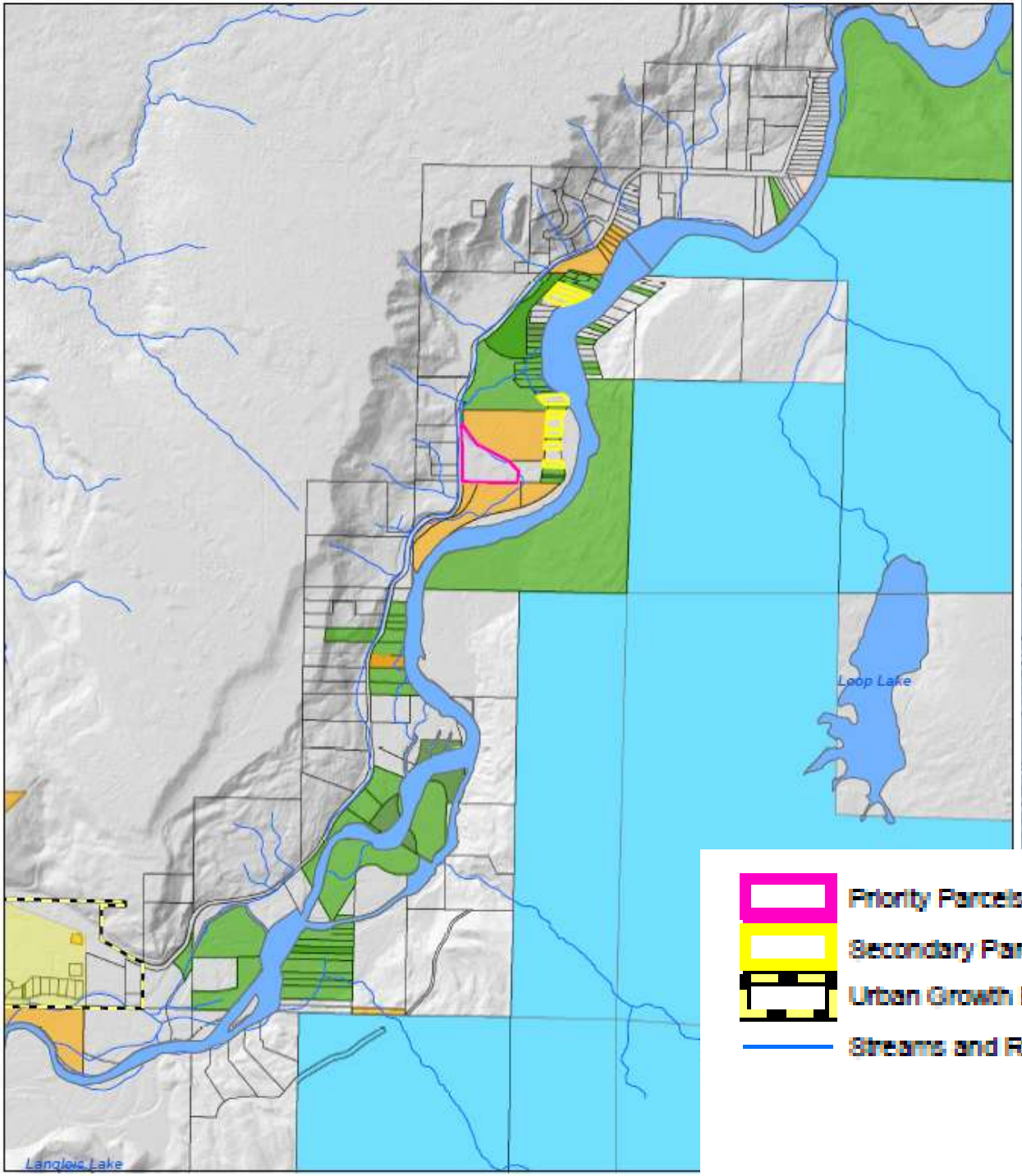
Tolt River- BEFORE

Tolt River - AFTER

AFTER - 2011

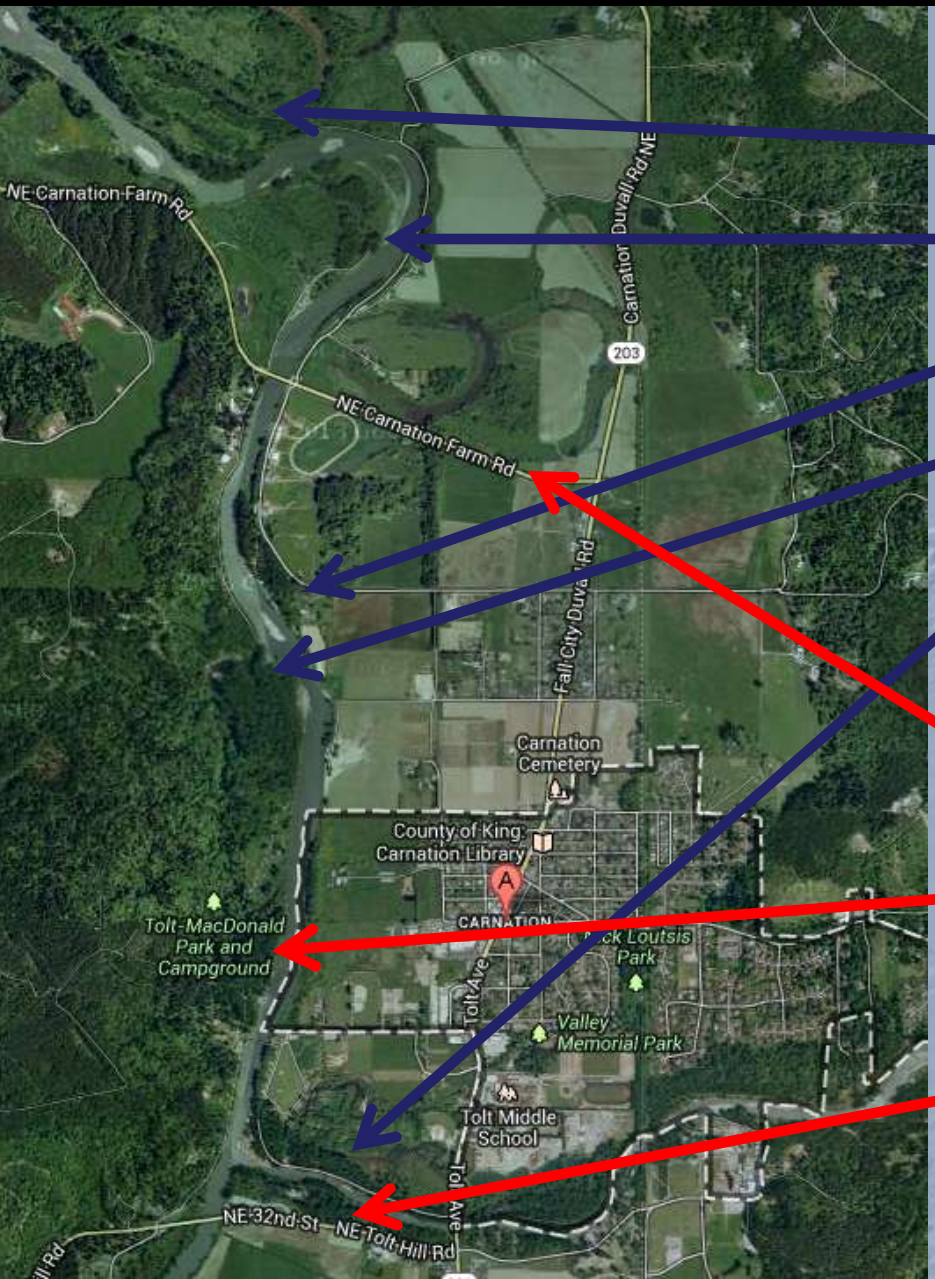

2009 - Preproject
2010 – Year 1 (peak flow 3100 cfs)
2011 – Year 2 (peak flow 7120 cfs)

Tolt River



Priority Parcels
Secondary Parcels
Urban Growth Boundary
Streams and Rivers
Incorporated Areas
Corridor Parcels
Public Land - City
Public Land - County
Public Land - State
CE Snoqualmie Forest

Opportunities Large projects



Stillwater

Chinook Bend

McElhoe-Pearson

Gilead

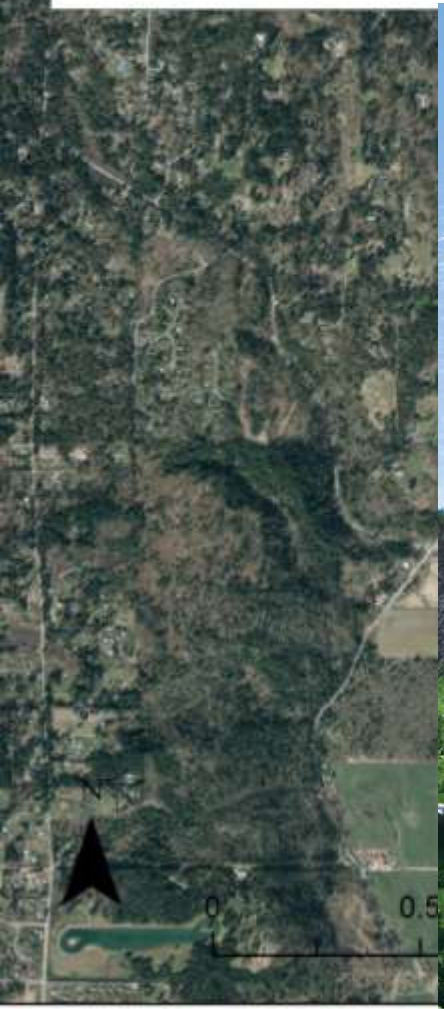
Lower Tolt

Put Road on Trestle

Remove failed revetment (left bank)

Remove/setback left bank Tolt Levee

Pumps and Floodgates
Floodplain Features
TYPE
DIVERSIONS (PUMP)
FLAP GATE


0
0.5

WITHOUT FISH SCREENS, FISH END UP WHERE THEY SHOULDN'T BE.

Ag Drainage

With a channel like this why are we talking about fish?

Because salmon and trout are actually in reed canary grass choked channels

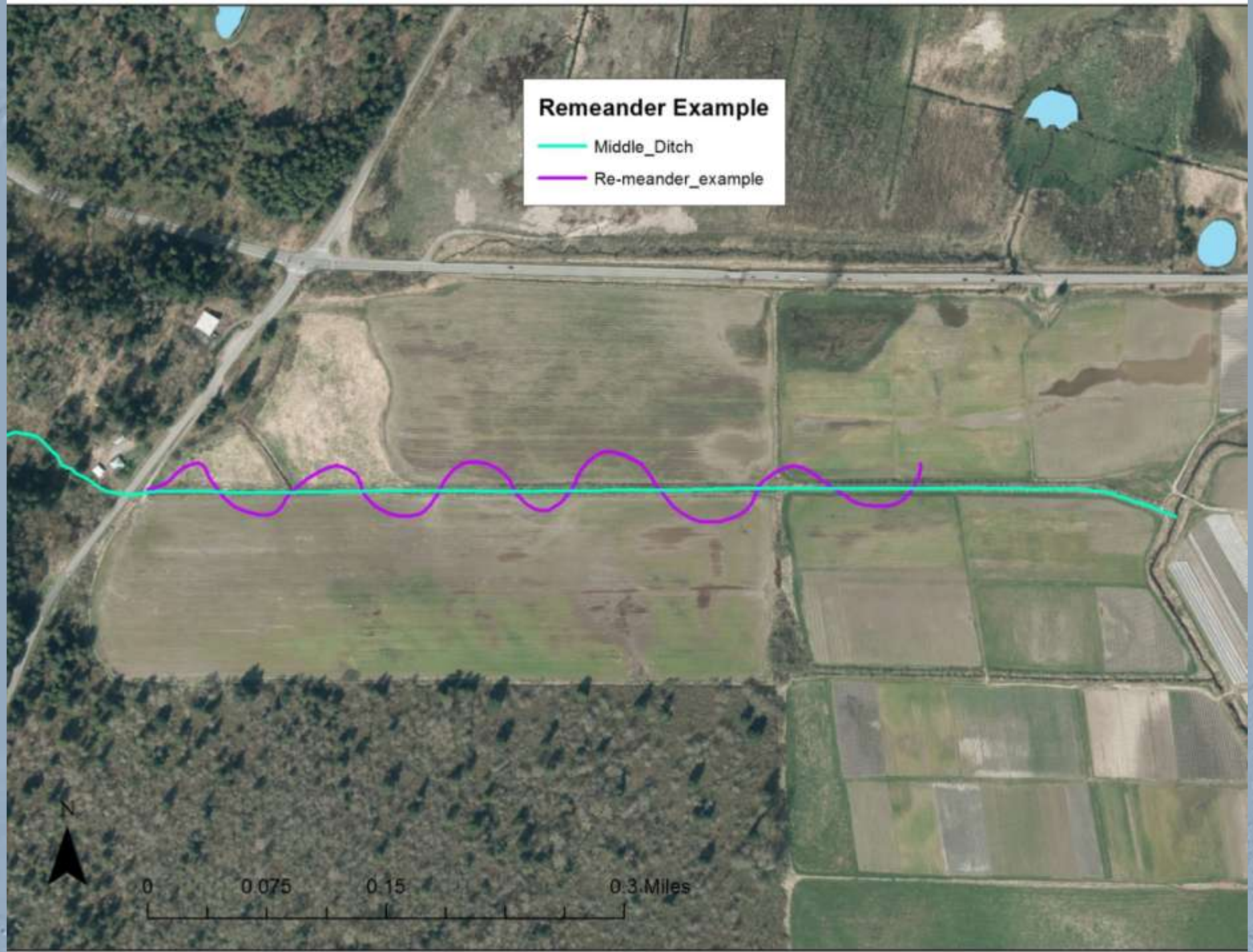
2008 fish data for 2000ft of “Middle ditch” of Tuck

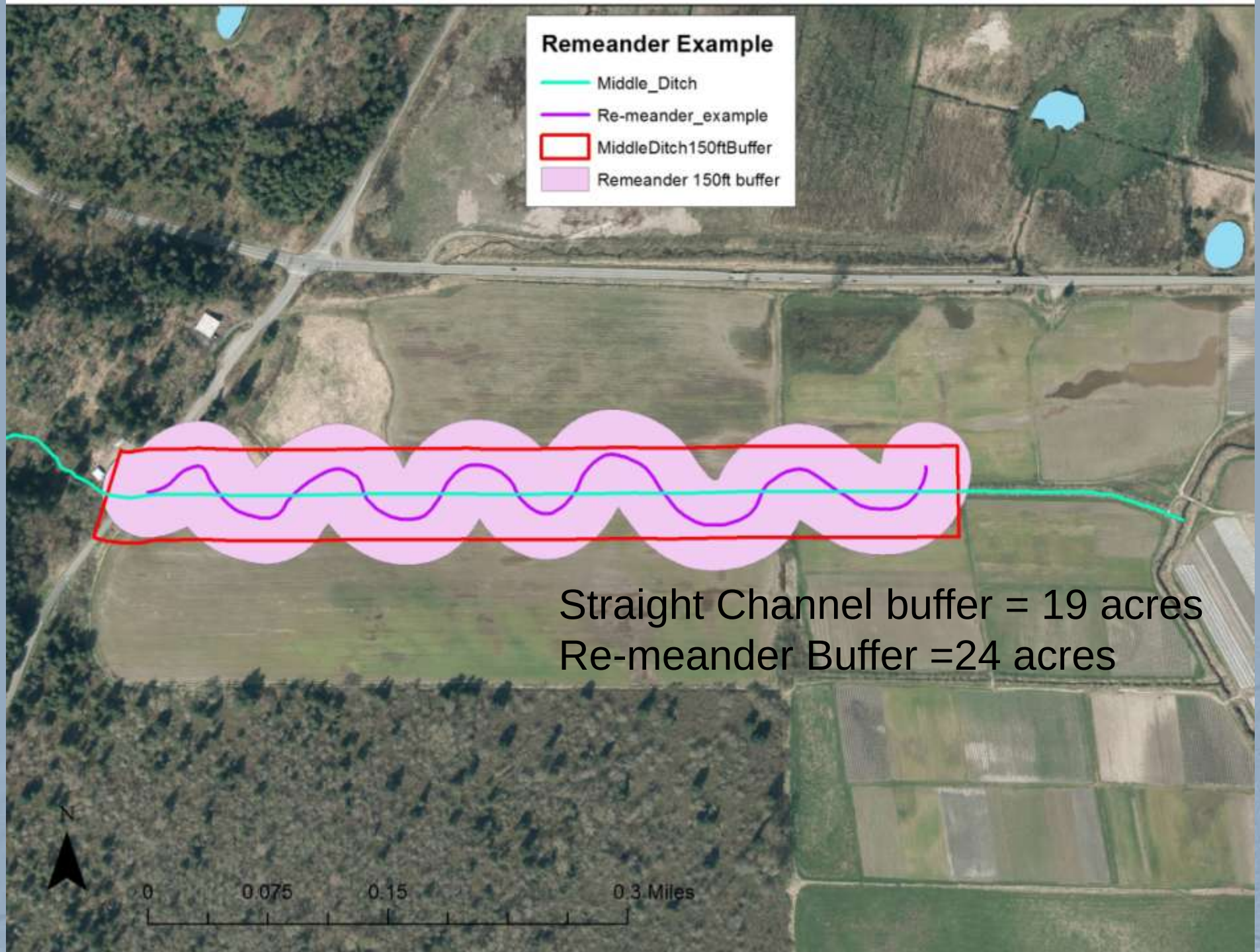
Species	Total
cutthroat trout	56
coho salmon	1925
steelhead trout	13
unidentified salmonid	9
three spine stickleback	617
river lamprey	1240
unidentified sculpin	48
pumpkinseed	1
NW salamander	5
giant salamander	7
red legged frog	19
bullfrog	2
crayfish	15
Total	3957

Ag Drainage

What's the big deal?

- Less habitat available
- Remaining habitat is simplified
- Higher summer temps
- Increased avian predation
- Direct mortality
- Mitigation typically "out of kind"


Remeander Example
Middle_Ditch
Re-meander_example
N
0
0.075
0.15
0.3 Miles


Remeander Example
Middle_Ditch
Re-meander_example
MiddleDitch150ftBuffer
Remeander 150ft buffer
Straight Channel buffer = 19 acres
Re-meander Buffer =24 acres
N
0
0.075
0.15
0.3 Miles

Riparian Buffer Functions

- Riparian areas provides
  - Large wood material
  - Insect/prey fall out
  - Organic inputs (leaf litter)
  - Shade (affects temp and DO)
  - Instream cover
  - Bank stabilization
  - Filter out and sediment, nutrients, pollutants and even flood debris

Buffers can also benefit Ag

- Can be part of addressing water quality issues
- Can shade out reed canary grass from streams/ditches—reducing drainage maintenance frequency and costs
- Slow floodwaters, building up natural levees and reducing erosive forces on banks
- Can act as a filter, reducing junk/debris from getting on fields.
- Help with some pollinator species

Plan Riparian Buffers

- Plan recommends 150ft buffers on all salmon bearings streams & 50ft non-salmon bearing
  - Was never mapped out to see what does that really mean on the ground
- 50 yr goals did not anticipate 100% coverage
  - Mainstem focus reaches need to be 80% intact
  - High coho salmon use streams 80% intact (e.g. Cherry, Patterson, Griffin)
  - Other fish bearing streams 65% intact

Large Wood

Large
Wood

Video if time

- EXTRAS to help with Questions

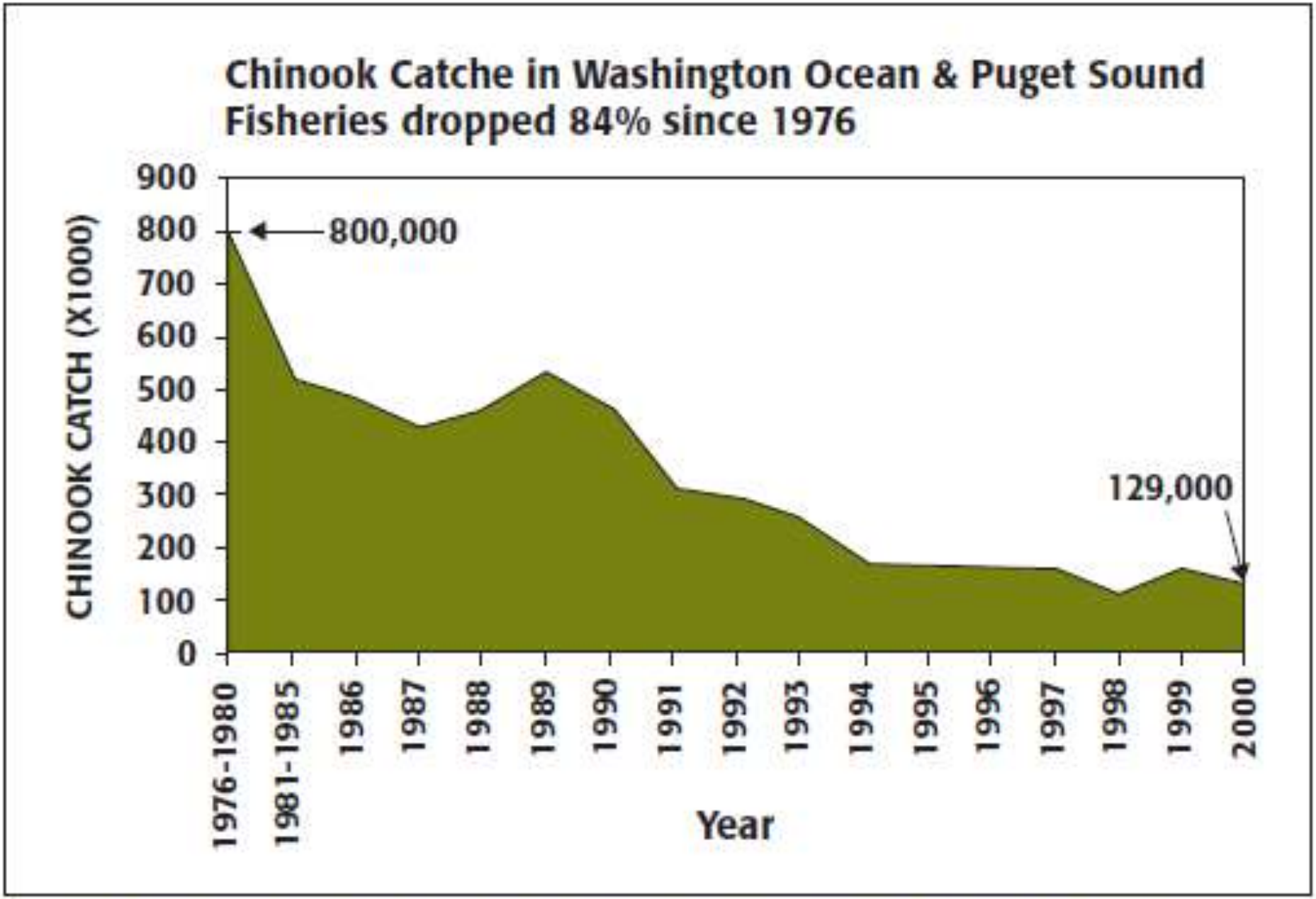


Figure 3.23 Total Chinook Catch in Washington Ocean and Puget Sound Fisheries, 1976 - 2000

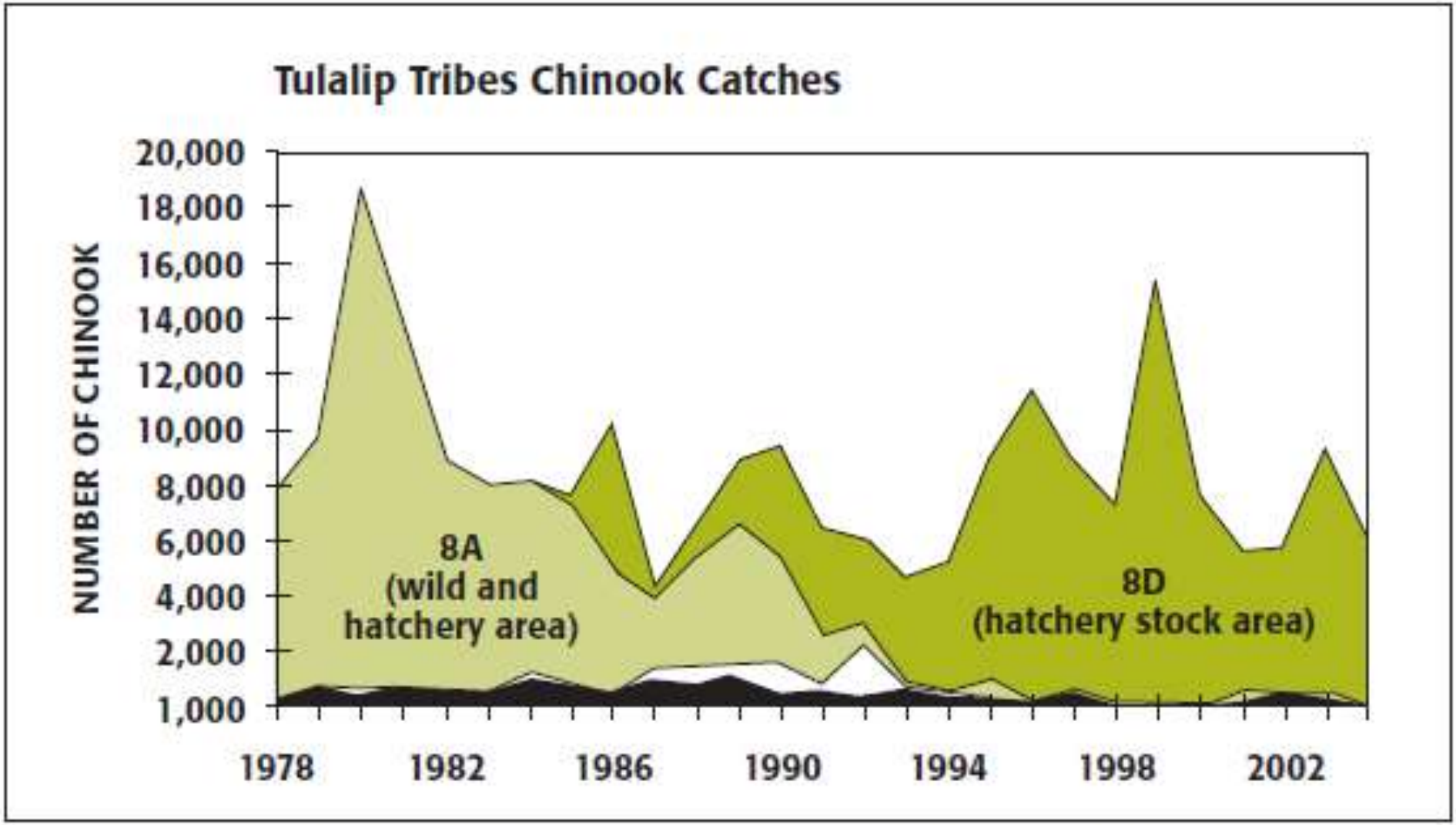
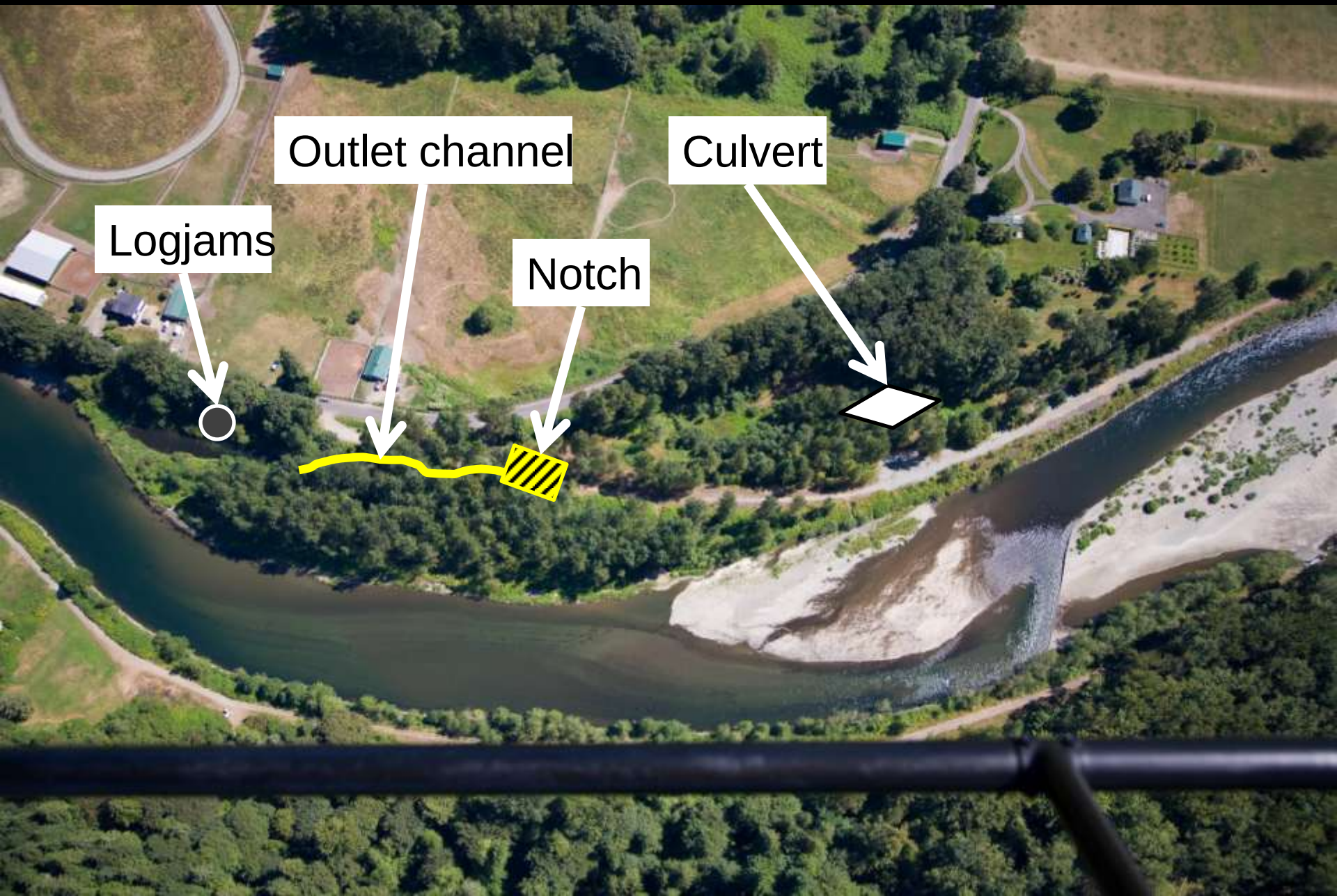


Figure 3.32 Graph showing the shift in the Tulalip Tribes chinook harvest from a mixed-stock area to a smaller area dominated by hatchery fish. By moving the fishery to a smaller area, the fishery has maintained overall harvest levels while reducing the rate of harvest on wild fish from approximately 50% to 5% (Source: Tulalip Tribes).

Brood year (b)	WDFW escapement estimates	Redd count (CR_b)	Eggs per Female (FE_b)	Total egg deposition (D_b)	Migration year (b+1)	Sub-yearling Chinook production estimate (SP_{b+1})	Egg - Migrant survival (S_b)
2001	3588	1435	4546	6522865	2002	131775	2.0%
2002	2895	1158	4451	5153977	2003	257262	5.0%
2003	1975	790	4924	3889887	2004	132805	3.4%
2004	2988	1195	3945	4715557	2005	137546	2.9%
2005	1279	512	4572	2339928	2006	156918	6.7%
2006	2615	1046	4693	4908964	2007	84350	1.7
2008	2560	1024	4130	4229575	2009	48134	1.1%
2009	895	358	5141	1840552	2010	86939	4.7%
2010	1788	715	4780	3417587	2011	79968	2.3%
2011	700	280	4273	1196542	2012	40632	3.4%

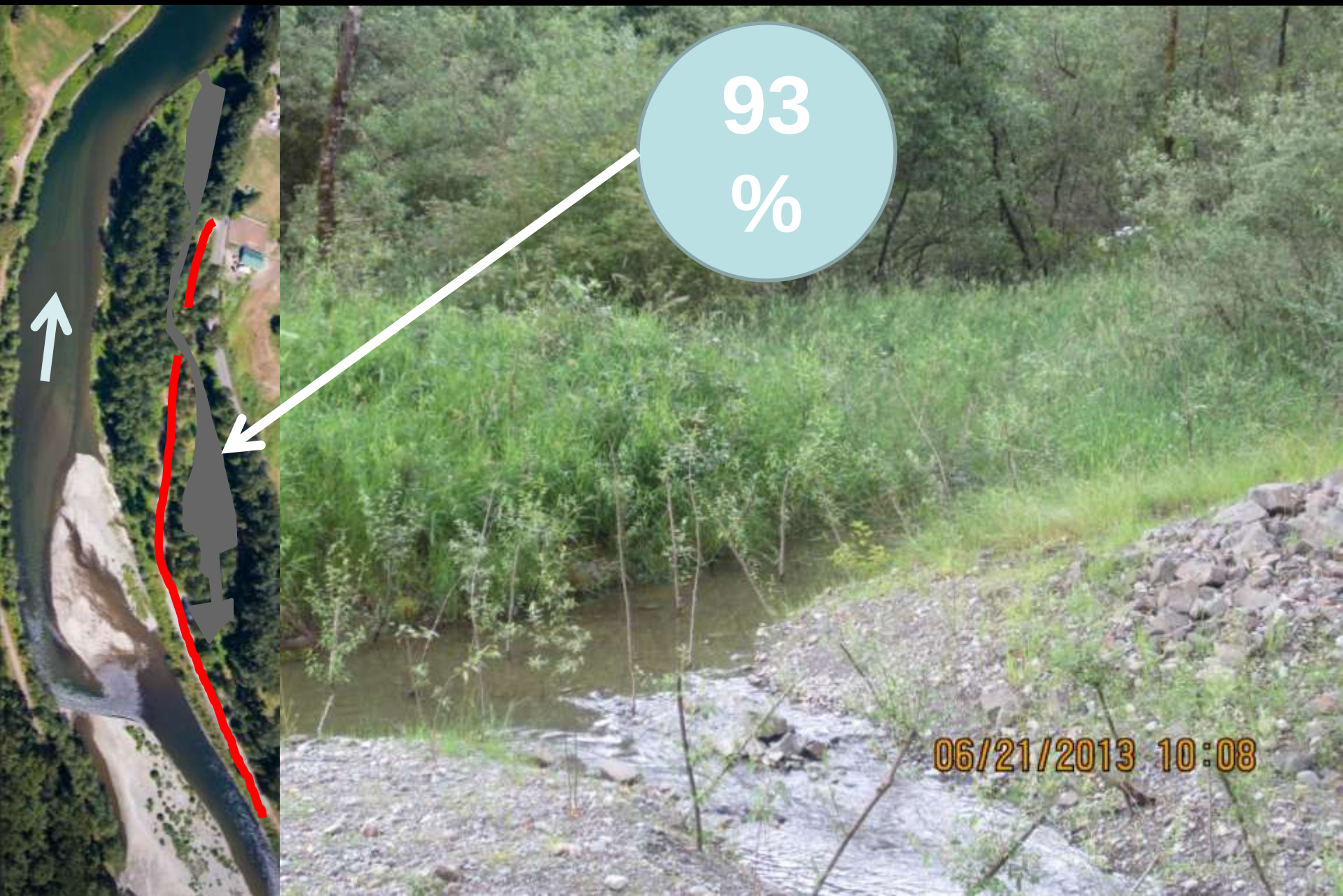
Table 22: Estimates of egg-migrant survival for wild sub-yearling Chinook produced in the Snoqualmie River for brood years 2001-2011.

McElhoe-Pearson Project



Where are the Chinook?

WHERE ARE THE COHO FRY?



From Tulalip smolt data

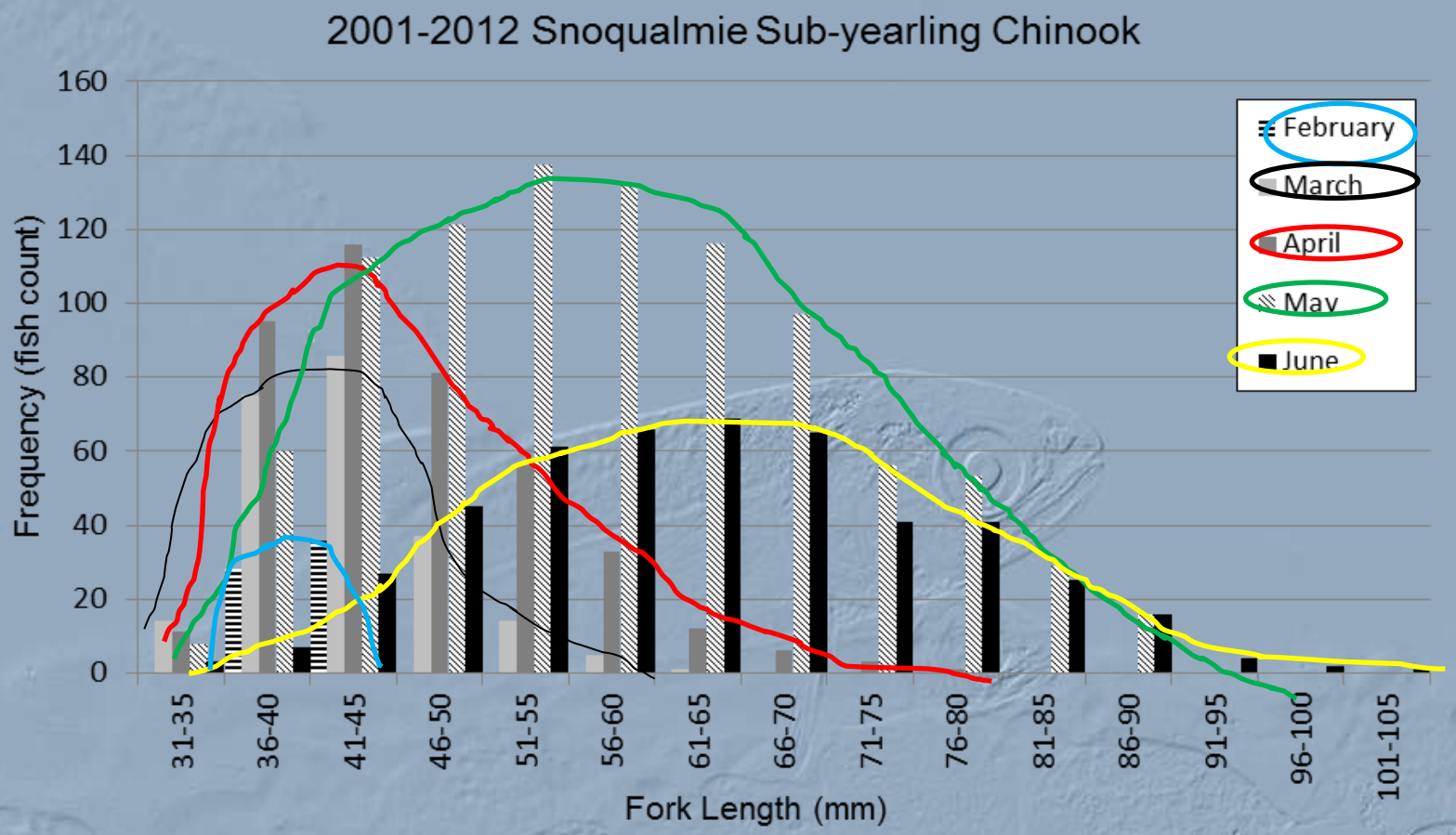
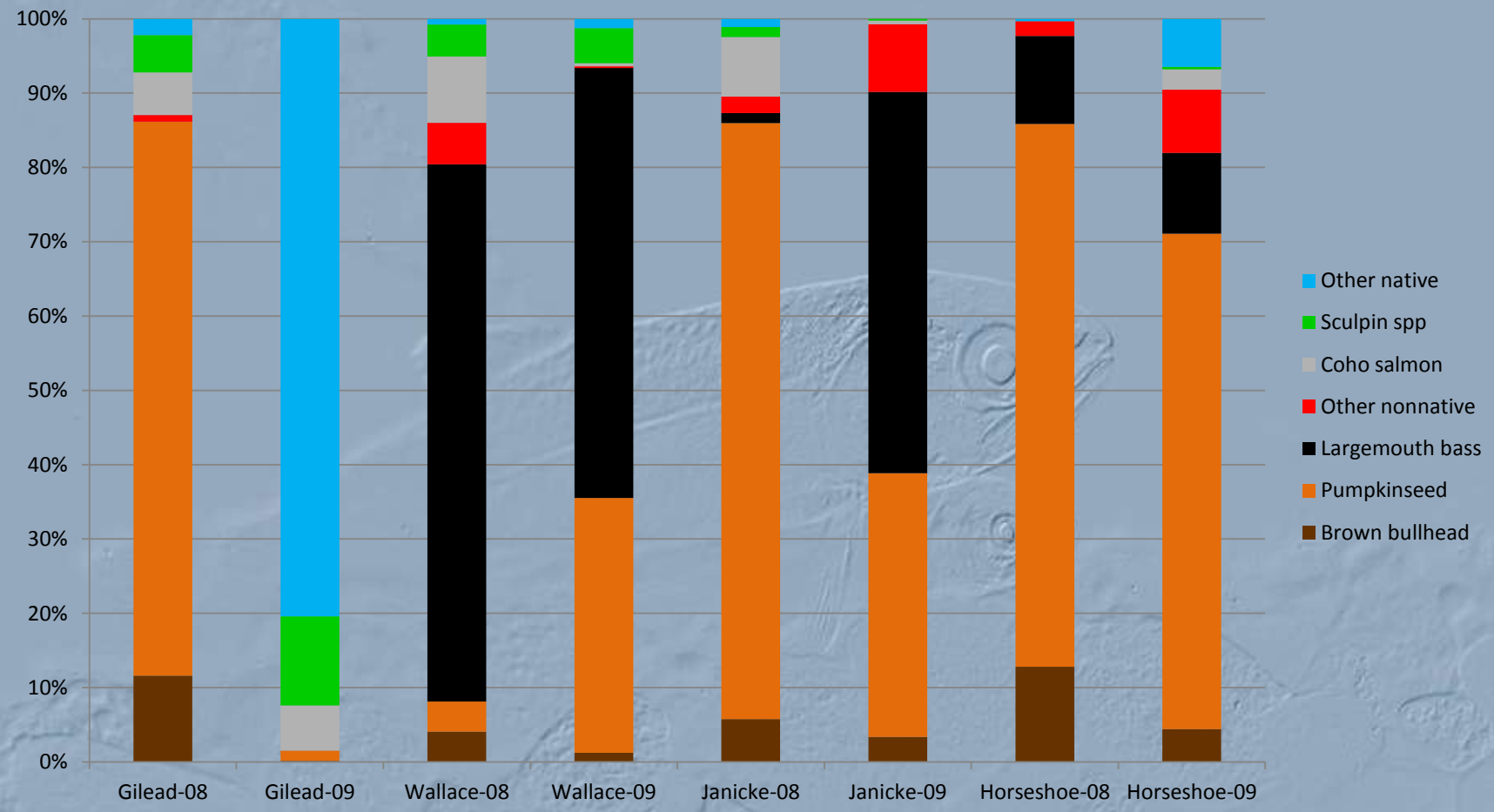


Figure 20: Fork length frequency distribution of wild sub-yearling Chinook measured at the Snoqualmie trap from 2000-2012.

Chinook Bend – BEFORE

Chinook Bend - AFTER

Dominant Species in Oxbows